



RESEARCH AND IMPACT REPORT

Argentina

Inclusive Rural Development Programme (PRODERI)

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Investing in rural people

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List of acronyms

AFIP	Administración Federal de Ingresos Públicos
ARS	Argentinean Peso
ATE	Average Treatment Effect
ATET	Average Treatment Effect on the Treated
CAST	Comité de Aprobación Territorial
CDD	Community-driven development
DIPROSE	Dirección General de Programas y Proyectos Sectoriales y Especiales
FACA	Fondo de Apoyo para Comunidades Agrarias
FACCLI	Apoyo de la Adaptación al Cambio Climático
FGD	Focus Group Discussion
FICO	Inversiones de Uso Colectivo para la Capitalización de Organizaciones Formales
FIES	Food Insecurity Experience Scale
FOCO	Fondo de Capital Operativo para Organizaciones de Beneficiarios
FOPAM	Fondo Productivo y de Acceso a Mercados
HDDS	Household Dietary Diversity Score
HH	Household
IA	Impact Assessment
IFAD	International Fund for Agricultural Development
IFFI	Incentivo para las Inversiones Familiares en Finca
INDEC	Instituto Nacional de Estadística y Censos
INTA	Instituto Nacional de Tecnología Agropecuaria
IPW	Inverse-Probability Weight
IPWRA	Inverse-Probability-Weighted Regression Adjustment
KII	Key Informant Interview
M&E	Monitoring and Evaluation
NEA	Nordeste Argentino
NOA	Noroeste Argentino
PCA	Principal Component Analysis
PDT	Plan de Desarrollo Territorial
PO	Producer Organization
POM	Potential Outcome Mean

PRODERI	Programa de Desarrollo Rural Incluyente
PSM	Propensity Score Matching
RIA	Research and Impact Assessment Division
SO	Strategic Objective
ToC	Theory of Change
UCAR	Unidad por el Cambio Rural
USD	US Dollar

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Executive summary

Although Argentina is an upper middle-income country with vast farmland and favorable natural conditions, poverty is widespread in rural areas. To improve the living conditions and reduce poverty among the rural population, the Argentinean Ministry of Agriculture, Livestock and Fisheries launched the Inclusive Rural Development Program (*Programa de Desarrollo Rural Incluyente* (PRODERI) in Spanish) in 2012. The program, which was co-funded by the Spanish Fund and the International Fund for Agricultural Development and counted with contributions from the final beneficiaries, was implemented in 17 of the 23 provinces of Argentina and closed in 2020.

PRODERI provided funding to producer organizations and indigenous communities to engage in productive development projects and to invest in community needs. The primary objective of these investments was to increase the productive capacities and market access of small-scale rural producers, thus raising incomes, reducing poverty, increasing shock resilience, and improving food security. Project design was demand driven. Producer organizations and indigenous communities identified development projects suited to their needs and capacity. Typical development projects that were funded by the program included the installation of water or other infrastructure (such as greenhouses and fences) and the acquisition of agricultural machinery (such as tractors) and inputs (such as beehives and small tools). These investments were complemented by the provision of training and technical advice.

The present impact assessment examines the impact attributable to PRODERI. It primarily focuses on impacts for members of producer organizations. Quantitative impact estimates, obtained through statistical matching and ex-post impact analysis methods, are enriched with insights from qualitative data collected through key-informant interviews and focus group discussions. The qualitative data help to interpret the quantitative findings and shed light on channels through which impact may have been achieved.

As a result of the program, beneficiary households are found to have substantially increased their agricultural production, both of crops and of animal-related products. This increase translated into significant gains in agricultural income and total household income. According to our interviewees, the specific program activities that made these impacts possible were investment in water and farm infrastructure as well as acquisition of machinery and inputs. No attributable impact was found on asset ownership of the beneficiaries.

The impact assessment shows that improved market access was only partially achieved among the beneficiary households. The increase in production led to more households selling their produce, but – among those selling – not to a higher value of sales revenue. A major reason for mixed results in terms of market access appears to be the remote location of many producers and producer organizations, implying poor mobile phone and internet connectivity, a poor road network, and long distances to potential buyers, public offices, and banks. These factors make formalization of both producer organizations and producing households as well as establishment of stable market linkages difficult, calling for more consideration of such factors in future program design.

PRODERI did not have an impact on the nutritional status and food security of the beneficiary households. While this finding may seem surprising, it needs to be interpreted in light of the very good starting conditions of households in our sample with respect to both their level of dietary diversity and food security, and from which a further improvement seems difficult to achieve.

There are mixed results regarding the impact of the program on resilience to shocks. While the impact estimates suggest that beneficiary households that recently experienced shocks are worse off than the control group in terms of their ability to recover from shocks, the impression of beneficiaries conveyed in qualitative interviews is quite the opposite. Yet, these interviews are only partially comparable to the survey data, as they capture the impressions of all households, i.e., those that had experienced shocks and those that had not.

PRODERI facilitated women's and youth participation in the design and implementation of the funded development projects, and our data show that there was indeed widespread involvement of both women and youth in the formulation and execution of projects. PRODERI significantly increased the likelihood for women to be part of the producer organization leadership in households with a female producer organization member. However, participation of women in the development projects as well as their engagement in leadership roles did not translate into greater empowerment within their own households, as women in beneficiary households neither increased their ownership of assets nor their decision-making with respect to agricultural activities or the use of income.

1. Introduction

The present report features the results of the impact assessment (IA) of PRODERI, conducted by the Research and Impact Assessment Division (RIA) of the International Fund for Agricultural Development (IFAD) in collaboration with the World Bank. As part of its Development Effectiveness Framework, IFAD conducts IAs to measure the attributable impact of IFAD operations on its beneficiaries in at least 15 per cent of its portfolio. For its 11th replenishment period (called IFAD 11), 24 projects and programs were selected among those that were closing between 2019 and 2021. PRODERI is one of these selected programs to undergo a rigorous IA for IFAD 11.

Argentina is an upper middle-income country with vast farmland and favorable natural conditions, which makes it a top producer of food in the world and a net exporter. The top three agricultural exports are soybeans, maize, and wheat (Munoz et al., 2021). Agricultural value added accounted for approximately six per cent of total gross domestic product in 2020 (World Bank, 2022). Agricultural land expanded from over 15 million hectares to 34 million hectares in the last 25 years, which is more than a doubling of total land devoted to agriculture (Munoz et al., 2021).

Argentina had experienced a severe economic crisis at the turn of the century, followed by a recovery over the first decade of the new century coupled with marked decreases in poverty. However, the gains from the economic expansion were not equally distributed as substantial regional disparities persist with rural areas and Northern provinces lagging significantly behind urban areas and the south and center (Garriga et al., 2015).

In the aftermath of the economic crisis, the concept of so-called family farming made its way to the political agenda of the left-wing governments at the time (Goulet, 2020).¹ Family farming is understood as a type of agricultural production, where the household unit and the production unit are physically integrated, the family provides the predominant part of the labor force used on the farm, and production is aimed both at self-consumption and the market (Ramilo and Prividera 2013). The idea was that family farming would substantially contribute to food security and food sovereignty of the country and would ensure the inclusive development of the most vulnerable population groups. It was thus to be protected and promoted (Goulet, 2020).

PRODERI is very much in line with this idea, as it aimed to improve the living conditions and reduce poverty among Argentina's rural population. This was to be achieved through increasing access to markets and integration into value chains for small-scale rural producers, thereby generating opportunities to increase productivity and incomes and improve food security.² PRODERI provided financing to producer organizations (PO) and indigenous communities to engage in productive development projects and to invest in community needs, respectively. Project design was demand-driven with government and/or contracted technicians working with POs and indigenous communities to identify development projects suited to group/community needs, demand, and capacity. The planned projects were described in a business plan and funded by PRODERI after formal approval.

Design, implementation, and administration of PRODERI was centralized in the *Unidad por el Cambio Rural* (UCAR) (since 2017 in the *Dirección General de Programas y Proyectos Sectoriales y Especiales* (DIPROSE)) in the Ministry of Agriculture, Livestock, and Fisheries, under the supervision of IFAD. The program deployed activities in 17 of the 23 provinces of Argentina between 2012 and 2020. The Government of Argentina funded 39 per cent of the program; the Spanish Fund contributed 33 per cent and the project beneficiaries co-funded 23 per cent. IFAD's contribution was smallest, with five per cent.

PRODERI had three components (IFAD, 2011), of which the first two are part of this IA:

1. Consolidation of capacities, technology transfer, productive and financial technical assistance, and strengthening of human and social capital

¹ The promotion of family farming is not at all specific to Argentina, but has been a development in many Latin American countries, especially the Mercosur. As Sabourin et al. (2020) describe, there are three generations of family farming policies, the first of which already date back to the 1950s-1980s.

² This setup of PRODERI identifies it nicely to be part of the third generation of family farming policies as defined by Sabourin et al. (2020). The third generation, which started around 2005 according to the authors, has comprised policies that address global development challenges, such as food security, climate change, or poverty. Policy instruments are no longer explicitly focused on family farmers, but are perceived as promising for their empowerment.

This component provided financial incentives in the form of matching grants and a lending pilot for working capital. Furthermore, it promoted the use of rural financial intermediaries as well as actions to strengthen POs, indigenous groups, young people, women, and rural wage earners.

2. Income generation, productivity, production, competitiveness, markets

This component included a production and market access fund with a capitalization strategy and a strategy to develop working capital credit systems.

3. Program management, coordination, and administration

This component supported the coordination and implementation of the program at both the national and provincial levels.

This IA seeks to identify the direct and indirect effects of PRODERI on its beneficiaries focusing on indicators for IFAD's economic goal, strategic objectives (SO), and mainstreaming themes:

- increased economic mobility (economic goal),
- increased productive capacity and quality (SO1),
- increased market access (SO2),
- greater resilience to climatic and other shocks (SO3),
- food security, and women's empowerment (mainstreaming themes).

The objective of the IA is twofold. First, it provides the impacts attributable to PRODERI and contributes to corporate reporting and accountability of IFAD operations. Second, it provides lessons and recommendations for future policy/program design and implementation by contributing to existing empirical evidence on impacts of similar programs on rural transformation.

Given the participatory nature of the program, PRODERI shares some characteristics with community-driven development (CDD) programs, which have been implemented in many countries in the last few decades. While CDD programs usually focus on the provision of public goods, such as roads, sanitation, drinking water, health, or education, PRODERI is concerned with investments in productive activities of a well-defined segment of the population. Yet, the similarity consists in the fact that a community – or a group, such as a PO – is in charge of identifying, implementing and maintaining its own externally funded development projects (White et al., 2018). CDD programs are found to produce clear impacts in establishing and improving the quality of small-scale village infrastructure, often in a cost-effective way, but little or no impact on social cohesion, social capital, and governance (White et al., 2018; Wong and Guggenheim, 2018). CDD programs also seem to have weak effects on health and mostly insignificant effects on education (White et al., 2018). In contrast, there is evidence of positive impacts on household consumption and living standards (Wong, 2012) as well as on increasing women's participation in decision-making forums (Wong and Guggenheim, 2018), although the latter may not translate into a change in power dynamics in the short term (White et al., 2018).

This report contributes to the literature by providing sound evidence of the effects of PRODERI on several household level indicators using an ex-post quasi-experimental evaluation design and employing a mixed-methods approach. Qualitative information was compiled in key-informant interviews (KIIs) and focus group discussions (FGDs) conducted in May and June 2021. Survey data for the quantitative analysis were collected among POs and households covering both treated (beneficiary) and untreated (non-beneficiary) groups between September and November 2021. The main strategy for the quantitative analysis is two-stage statistical matching. In the first stage, we matched treated POs to untreated POs to ensure a robust sampling frame for household-level survey data collection. In the second stage, we matched treated households to control households to ensure a robust estimation of treatment effects. This strategy allows to construct a valid counterfactual, which implies that the non-beneficiary households (control group) are a good representation of what the beneficiary households (treated group) would have been like had they not benefitted from PRODERI. We estimate the impact attributable to the program using Inverse-Probability-Weighted Regression Adjustment (IPWRA) and conduct robustness checks using nearest-neighbor matching.

The impacts we present are estimates of the average impact of typical PRODERI investment in POs, which is an important caveat for the following reasons. First, the program had almost nationwide coverage. Argentina is a huge country, with a highly diverse geography, varying altitudes and climatic zones, a wide range of population densities, and varying capacities across the provinces to implement a program like PRODERI. While our sample is not large enough to produce statistically meaningful impact estimates at different levels of these features (for example, to compare impacts in highly

populated areas vs. impacts in lowly populated areas), we do make sure to control for all the observable characteristics that might have influenced participation and performance in our statistical and econometric analysis. Second, as we illustrate below, we focus on a specific set of PRODERI-funded projects, namely the most typical ones, and leave out projects in indigenous communities that were focused on the provision of water for consumption purposes. We did so because these projects had a public goods nature and did not primarily promote productive activities, which made them different from projects funded for POs. Third, the POs and households that benefitted from the considered PRODERI-funded projects engage in a wide range of activities, ranging from growing crops and raising livestock and poultry to keeping bees and processing agricultural produce. For the most part, the impact estimates we present in this report are not specific to each of these activities due to the large sample such an analysis would require, and hence they represent average impacts for the population of interest.

The remainder of this report is structured as follows. We present in Section 2 the Theory of Change of PRODERI's pathways and the main research questions. In Section 3 we describe the sampling framework, dataset, and methodologies to estimate impact. We show the main characteristics of the sampled communities and households in Section 4 and discuss the results of the IPWRA in Section 5. We conclude the study in Section 6 by highlighting lessons learned and recommendations for future policy and program design.

2. Theory of change and main research questions

The objective of PRODERI was to improve the living conditions and reduce rural poverty through the combination of several factors, including:

- i. the consolidation of production and income-generating capacity through the provision of fixed and working capital,
- ii. the incorporation of technology to permit the stable and cost-effective entry into markets,
- iii. the provision of productive and commercial infrastructure to POs that allow their members to mitigate vulnerability and/or economic insecurity,
- iv. the provision of training, information, and technology to POs to increase productivity and market access, and
- v. the promotion of social capital and organizational capacity building through technical assistance and facilitation of ownership of development projects.

2.1 PRODERI theory of change

Owing to the demand-driven, participatory nature of the elaboration of business plans, the projects that were funded by PRODERI spanned a large array of sectors and investments. Although most projects focused on improving productive capacity (for example, through purchase of tractors or beehives), a number of projects, predominantly those in indigenous communities, identified demand for infrastructure to facilitate access to water for consumption (rather than for production). Due to this diversity among projects, the program's Theory of Change (ToC) spans a large variety of activities, outputs, and outcomes at multiple levels. Projects were funded through a mixture of grants, loans, and beneficiary funds. Most funding provided non-reimbursable grants to the projects. To build community and organization buy-in to the projects, funding was disbursed on confirmation of co-investment by beneficiaries.

The program made funding available through two funds, the *Fondo Productivo y de Acceso a Mercados (FOPAM)* and the *Fondo de Capital Operativo para Organizaciones de Beneficiarios (FOCO)*. These funds differed in their target groups and objectives. FOCO largely targeted formalized groups with the goal of furnishing them with working capital to invest in themselves and their members. FOPAM - through four financing lines - invested in communities and POs to increase productivity, incomes, market access, and access to services, among others. The financing lines of FOPAM are as follows:

- i. *Incentivo para las Inversiones Familiares en Finca (IFFI)*: Financing for projects to increase incomes and support the sustainable insertion into markets and value chains.
- ii. *Inversiones de Uso Colectivo para la Capitalización de Organizaciones Formales (FICO)*: Financing for projects to increase the organizational capacity and formalization of groups to allow them to better manage themselves, investments, projects, and their production.
- iii. *Apoyo de la Adaptación al Cambio Climático (FACCLI)*: Financing for adaptation to climate change and activities to increase resilience to climatic shocks.
- iv. *Fondo de Apoyo para Comunidades Agrarias (FACA)*: Financing for investment in infrastructure to improve livelihoods and incomes in indigenous communities.

The fund(s) and/or funding line(s) that a project received reveals the type of investment and support they received. As outlined in Figure 1, the funding mechanisms define the program inputs and activities, and investments were made both at the community/PO level and at the household level.

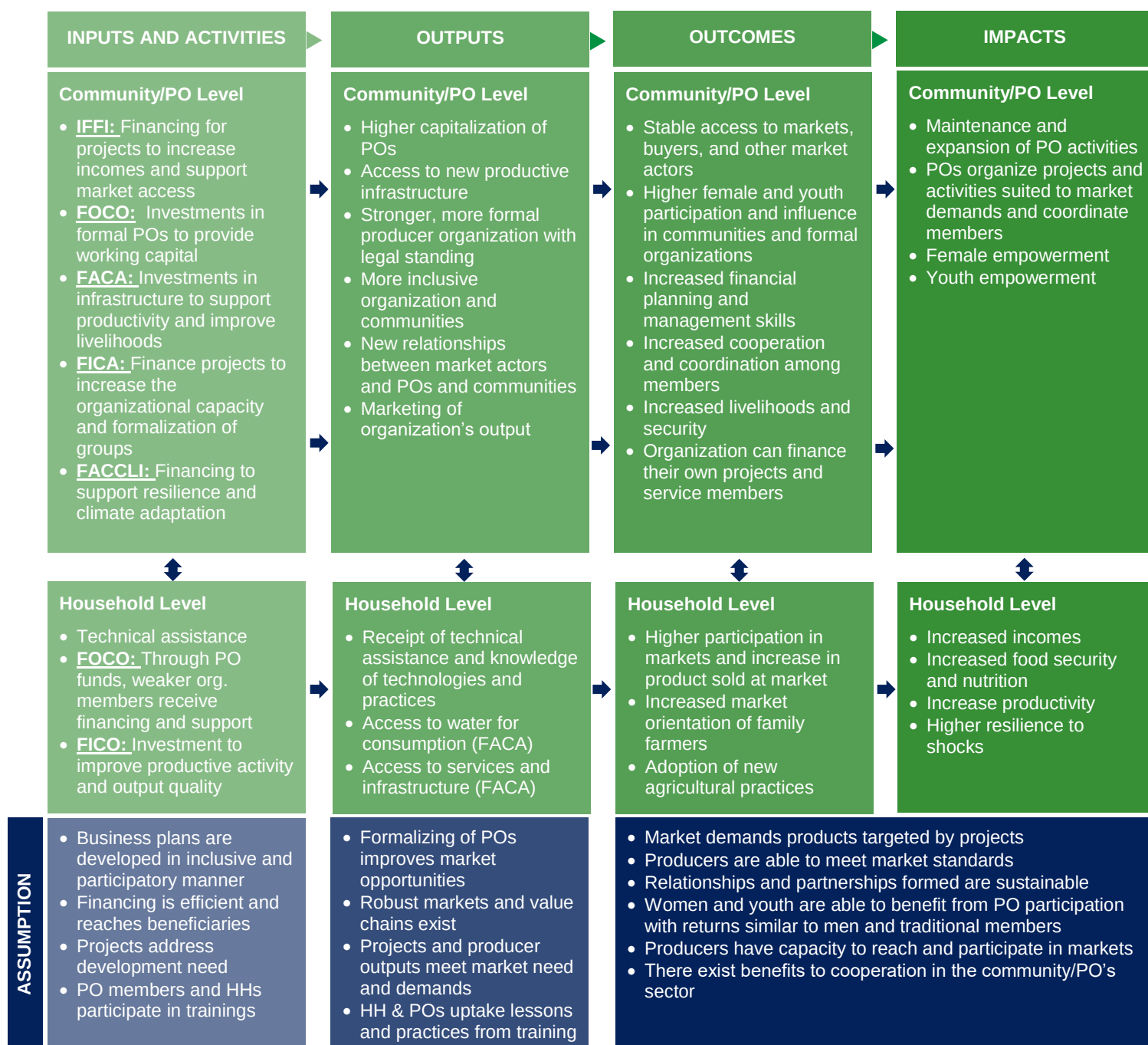
In addition to investments in infrastructure, productive assets, and working capital, projects were usually provided technical assistance and training by government technicians. Training took a variety of forms and the content varied according to the needs of the project and the funding mechanism employed. For example, FOCO aimed to provide POs with working capital; it was thus typically paired with training on financial management and organizational capacity. IFFI, on the other hand, focused on increasing productive capacity and market access; so, training and assistance were more focused on best practices, identifying market demand, and producing for the market. Although funding mechanisms were tied to their own set of objectives, it is difficult in practice to parse exactly

which set of funds were used for which set of project activities. Moreover, many projects would receive funds from multiple sources that in the end were all tied to the same project level goals and outcomes.

The causal chain through which PRODERI impacts are expected is detailed in the ToC in Figure 1. PRODERI's expected impacts, like the other steps along the causal chain, are at the community/PO level and at the household level. The investments through each of the funds map to the same set of program impacts, which correspond to IFAD's economic goal, SOs, and mainstreaming themes. At the community/PO level, groups are expected to be empowered, formalized and trained, and to gain sufficient capacity to better market their output, improve their planning, and invest efficiently in themselves and their members. These activities (among others) are expected to generate community/PO level impacts, including long-run, market-responsive and efficient organization, as well as female and youth empowerment. In addition to the community/PO level impacts, these activities also contribute to household-level impacts, including increased incomes, food security and nutrition, productivity, and resilience to shocks. The household impacts are also expected through the household-level inputs and activities that operate in conjunction with the group-level activities. The household-level inputs come in the form of technical assistance (usually targeting agricultural practices) and individual investments. For example, FOCO provided working capital to POs but, in practice, was also implemented at the individual-level as organization members, who were deemed as more needing of assistance, received funds to bring their production to a level similar to the rest of the PO members. These types of investments combined with technical assistance and the group-level investments are expected to generate increases in output, market access, and sales for group members resulting in higher incomes and productivity in the long-run.

In addition to outlining the pathway from inputs and activities to impact, the assumptions underlying the ToC are also listed in Figure 1. The main assumptions at the beginning of the causal chain are that POs and indigenous communities have incentives to come together to identify local development needs, develop ideas for suitable development projects, and formulate them in business plans. Once PRODERI funding has been granted, the program can produce impact only if the program funds and technical assistance actually reach the intended beneficiaries. Furthermore, it is important that the beneficiaries participate in the program-funded training courses, that these deliver useful content, and that the beneficiaries take up lessons and practices from this training. It is a crucial assumption that formalization and capitalization of POs helps to improve the productive capacities and market opportunities of their members. In order to achieve integration into value chains and greater market access, it is assumed that the targeted beneficiaries produce goods that meet market demand. In addition, there should not be insuperable barriers to accessing the market, neither in the form of quality standards nor in the form of physical access problems. Instead, it is assumed that business relationships with large buyers, like supermarkets or hotels, come with multiple benefits: they should not only secure better and more stable prices for the PO members, but also provide learning in terms of product quality, logistics, required scale and interpretation of customer needs. It is also assumed that such relationships are not only one-time but are sustained (at least during the lifetime of the project) for the activities to lead to outcomes and impacts listed in the ToC. Finally, it is assumed that all beneficiaries benefit from all activities in the same way, regardless of their gender or age.

Figure 1: Theory of Change



2.2 Project coverage and targeting

The target population of the program was broadly the rural poor population. PRODERI's estimated number of direct beneficiaries was planned to be 37,500 families; 25,500 of which were planned to be poor households of small-scale producers engaged in family farming. An additional 12,000 beneficiaries were planned to be families with high levels of vulnerability, including in indigenous communities (IFAD, 2011).

In order to access the support of the program, rural households and POs had to fulfill two criteria: (i) households had to be a member of a qualified - formal or informal - group defined here as PO (e.g.,

cooperative, association, foundation, producer group, etc.); and (ii) the share of PO member households with incomes higher than twice the minimum wage of a rural laborer (as stipulated by law) could not exceed 20 per cent. The program benefited all rural households in indigenous communities made up of eligible producers due to their generally high levels of vulnerability.

The program's targeting strategy was as follows:

- Provincial governments created *Planes de Desarrollo Territorial (PDT)* outlining provincial strategies, regions, value chains, and sectors to be targeted. PDTs were submitted to central coordinators for approval and recommendations.
- Communities and POs self-selected into the program and prepared *Planes de Negocio* (business plans) for projects to be supported by PRODERI. This was a participatory process in which local demands and needs were to be defined. The communities and POs received technical assistance by program technicians and consultants before submission. The business plan had to contain details about the current legal state of the applicant group, the objective of their project, and its anticipated results. In addition, applicants were asked to identify the necessary level of investment at the community/PO and household level, the amount of beneficiary and solicited funding, their working capital needs, their need for technical assistance and training, relevant organizational and commercial aspects, potential environmental impacts/ mitigation, and lastly the expected cost, budget, disbursement plan, and sources of financing.
- Business plans for projects were considered and approved based on their alignment with the goals and priorities of the PDTs and the targeting strategy of PRODERI. After submission of the project plan, the program's provincial and central execution units created a technical report for each project outlining the budget and analyzing the technical, managerial, financial, environmental, social, and commercial aspects of the project.

Final evaluation of the projects was conducted by the corresponding *Comité de Aprobación Territorial (CAST)* considering the following criteria: (i) alignment with the PDT, (ii) beneficiary eligibility, (iii) proposed technical assistance and training and budget, (iv) the potential benefit of the project to beneficiaries, (v) project sustainability and viability, (vi) and gender equity and youth participation.

We obtained data on the supported projects from the monitoring and evaluation (M&E) system from DIPROSE at the Ministry of Agriculture, Livestock, and Fisheries. These data contain detailed information on the type of funding, number of beneficiary families, and disbursement amounts and dates. According to these data, 445 projects received program benefits in total. This is broadly equivalent to 445 beneficiary POs or indigenous communities, as the same recipient could not receive funding for more than one project.³ Table 1 reports the distribution of recipients – families and groups – by province and Figure 2 shows the geographical distribution of projects funded by PRODERI. The final number of direct beneficiaries is somewhat lower than the target (21,424 vs. 37,500).

Table 1: Distribution of beneficiaries by type of group and province

Province	Communities		Formal Groups		Informal Groups		Total	
	Families	Groups	Families	Groups	Families	Groups	Families	Groups
Buenos Aires	0	0	396	6	153	3	549	9
Catamarca	300	1	1,181	36	114	5	1,595	42
Chaco	310	9	1,152	48	20	2	1,482	59
Chubut	26	2	66	3	43	5	135	10
Córdoba	0	0	52	3	331	24	383	27
Corrientes	0	0	331	15	2,033	6	2,364	21
Entre Ríos	0	0	170	6	115	12	285	18
Jujuy	1,130	20	629	11	890	14	2,649	45
La Rioja	125	1	885	8	42	2	1,052	11
Mendoza	217	2	788	24	31	3	1,036	29

³ However, in a few cases (in Jujuy province), projects were implemented together by several POs.

Misiones	11	1	190	12	160	7	361	20
Neuquén	358	5	349	12	53	5	760	22
Rio Negro	33	2	523	9	79	5	635	16
Salta	3,755	16	970	18	264	4	4,989	38
San Juan	0	0	150	7	176	19	326	26
Santiago del Estero	742	4	365	5	156	12	1,263	21
Tucumán	508	5	884	18	168	8	1,560	31
Total	7,515	68	9,081	241	4,828	136	21,424	445

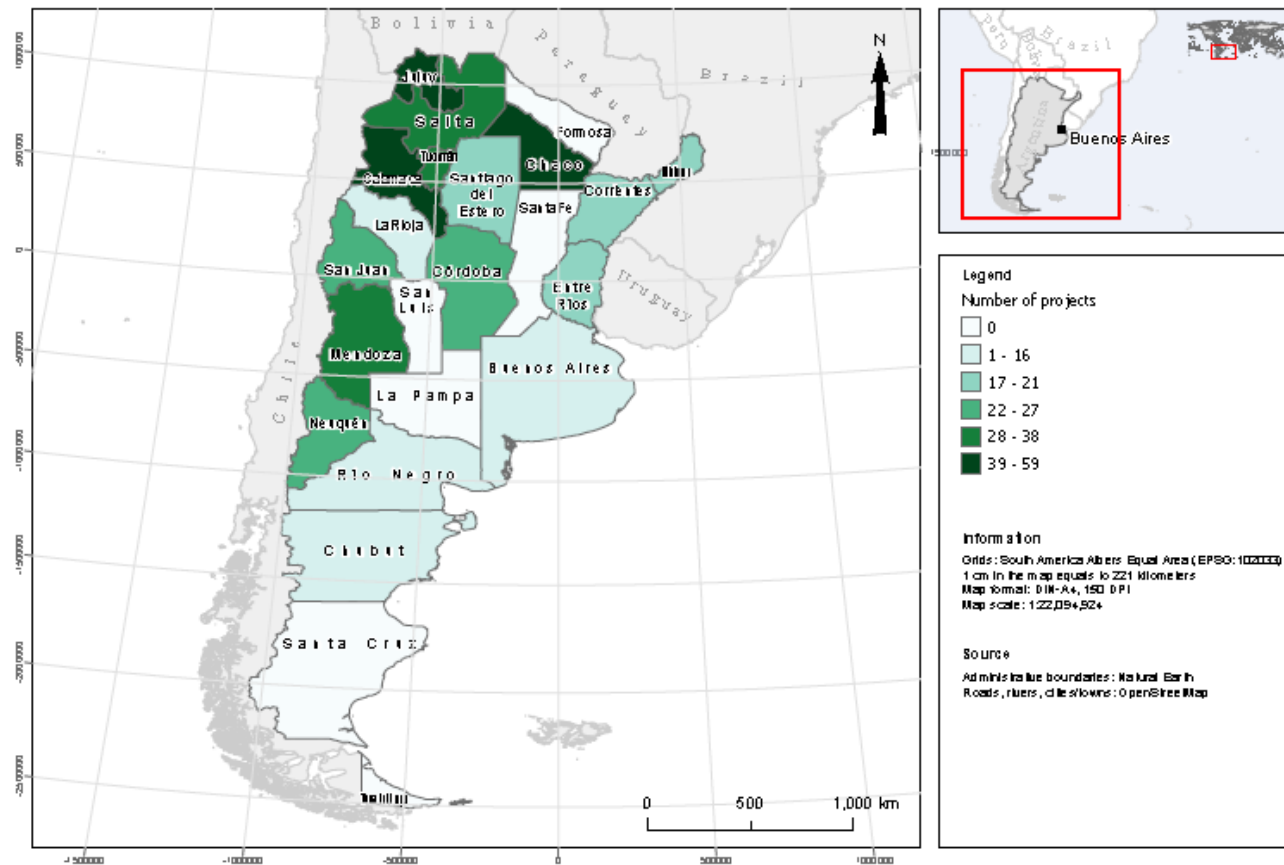
Note: Informal groups are groups that are not registered as such, in this case they are listed as *grupos de hecho* and *grupos de productores* in the M&E data. The legal status reported refers to the time of submitting a business plan for a project to be supported by PRODERI.

Examples for projects that were realized are:

- improved production practices allowing for an increase in scale and productivity in all production activities (pasture, meat, horticulture, beekeeping, poultry, etc.),
- improving marketing practices,
- procurement and installation of communication equipment,
- construction of greenhouses⁴ and procurement of tools,
- acquisition of machinery,
- provision of water to dwellings with cisterns, community wells or other mechanisms, with the installation of hoses, tanks, pumps or other tools or devices,
- improvement of infrastructure for water harvesting and the provision of different types of irrigation for production, and
- construction of fences and other farm infrastructures for livestock and production management.

⁴ Greenhouses were predominantly constructed in Patagonia where horticultural production is naturally very difficult.

Figure 2: Geographical distribution of PRODRI projects



Projects were not approved and hence implemented at the same time across the provinces. According to the M&E data, the first project was approved in April 2013 and the last project in October 2019. Projects received their funding in up to three tranches. Provinces in the region of the *Noroeste Argentino* (NOA) were the early implementers, while provinces in the *Nordeste Argentino* (NEA), Pampas and Patagonia rather late implementers. In fact, according to information from program staff, early projects were more comprehensive focusing on both productivity enhancement and organizational strengthening / capacity building. As program implementation continued, later projects tended to focus more on increasing productivity and market access due largely to the need to close the projects by the time of program closure. This implies that early projects may have benefited from other, or more, funds / funding lines than later projects. We nevertheless decided to remain agnostic to the overall composition of funds. Ultimately, this IA treats each project's unique combination of funding as a package.⁵ This strategy is in line with the ToC as all the funds are expected to contribute to the same long-term impacts and simplifies the evaluation allowing for the concrete identification of program impact. As funds largely overlap, it would have been infeasible to collect a large enough sample to disentangle funds to identify their individual or additive impacts. Moreover, their individual impacts are arguably of less relevance in the evaluation of PRODERI. In participatory programs of this type, project activities and the use of invested funds are endogenous in that each community/PO first chooses to participate, then decides on the activities based on member demands and needs. By extension, the choice of funding mechanism in PRODERI is also endogenously determined by the needs of the project. Therefore, the relevant questions for the program's evaluation are not whether each fund had an impact or which fund (or funding line) was relatively more effective, but whether the program – through the mechanisms made available – met the development needs of communities and organizations. By evaluating total funding and funds as a package, we are able to assess whether the program met development needs regardless of their specifics.

2.3 Research questions

From the ToC outlined in Figure 1 and through discussions with program implementers, we developed a series of testable research questions at three levels.

- 1) The first set of questions relates to the output, outcome, and impact stages at household level:

- Question 1:** Did the program have the intended effect on beneficiary households in terms of increased income and assets?
- Question 2:** Did PRODERI increase productive capacities of beneficiary households?
- Question 3:** Did the program help the beneficiary households to access markets and to sell their production at these markets at higher prices?
- Question 4:** Do members of participating organizations exhibit higher levels of food security than non-participants?
- Question 5:** Are members of PRODERI organizations better able to respond to shocks and recover, compared to non-beneficiaries?
- Question 6:** Did participating households attend training courses?

- 2) The second set of questions relates to the output, outcome, and impact stages at PO / community level:

- Question 7:** Are participating organizations and communities strengthened in their organizational capacities? Do they exhibit better financial planning and management skills as well as higher cooperation among their members, compared to non-beneficiary organizations and communities?
- Question 8:** Do participating organizations and communities gain access and become integrated into value chains through new relationships with market actors?
- Question 9:** Are women and youth more active participants in participating organizations and communities, compared to untreated ones? Do women and youth show higher empowerment than their counterparts in non-participating organizations and communities?

- 3) The third set of questions touches on the context of PRODERI's implementation as well as unintended effects.

- Question 10:** What are the conditioning factors that facilitated or hindered impact at the household level?

⁵ This strategy is also common in the evaluation of CDD programs. Because they are demand driven, it is typically infeasible to evaluate each iteration of treatment existing within the program, so assessments rely on random selection and define treatment as participation in the program and focus on targeting when stratifying (Masuri & Rao 2004; Wong 2012).

Question 11: Are there any unintended effects by PRODERI interventions?

Question 12: What are the main constraints that POs and indigenous communities face?

Table 2 summarizes the links between these research questions and IFAD's economic goal, the three strategic objectives (SOs) and the mainstreaming themes.

Table 2: Research question matrix and IFAD's strategic objectives

Research question	Goal: Economic Mobility	SO1: Productive capacities	SO2: Engagement in markets	SO3: Resilience	Mainstreaming (gender, youth, nutrition)
Question 1	X				
Question 2		X			
Question 3			X		
Question 4					X
Question 5				X	
Question 6		X			
Question 7		X	X		
Question 8			X		
Question 9					X
Question 10	Contextual analysis related to all goals and SOs				
Question 11	Contextual analysis related to all goals and SOs				
Question 12	Contextual analysis related to all goals and SOs				

3. Impact assessment design: Data and methodology

3.1 Mixed-methods research approach

This IA takes a mixed-methods approach. The main focus is on quantitative data collected in the form of surveys among households and POs. These data are analyzed to quantify the impact of PRODERI that can be attributable to its interventions using a robust counterfactual (control group).

In addition, qualitative information was collected in KIIs and FGDs. KIIs were conducted with leaders of POs, program officials, technicians, leaders of indigenous communities, and entrepreneurs linked to the productive chains supported by PRODERI. FGDs were run with members of beneficiary households.

These qualitative data serve two purposes. First, to contextualize the findings of the quantitative analysis, especially regarding the targeting and implementation of the program as well as any channels through which PRODERI investments affect the key outcomes of interest. This also complements the lessons learned from the quantitative analysis. Second, to study the successes and bottlenecks of implementation and, to the extent possible, the contributions of PRODERI to livelihoods in indigenous communities (rather than POs). Investments supported by PRODERI in indigenous communities were of quite a different nature than projects of POs and often took a public goods nature in the form of investments in water for consumption, rather than investments in productive capacities.

The quantitative assessment strategy allows for a precise measurement of the impacts referred to in the first nine research questions (Table 3). The same sets of research questions are investigated with the help of the qualitative data for indigenous communities. Last but not least, we use the qualitative information to study research questions 10-12.

Table 3: Research question matrix and qualitative-quantitative approach

Research question	Quantitative approach	Qualitative approach
Question 1	X	X
Question 2	X	X
Question 3	X	X
Question 4	X	X
Question 5	X	X
Question 6	X	X
Question 7	X	X
Question 8	X	X
Question 9	X	X
Question 10		X
Question 11		X
Question 12		X

3.2 Sample design

a) Quantitative sample

This IA, like others at RIA, uses a multi-stage sampling approach for the quantitative data collection. In the first stage, we selected POs, both treated and untreated. This first stage consisted of statistical matching and random sampling of organizations to guarantee internal validity and to obtain a control group of viable counterfactual organizations. In the second stage, we randomly sampled households that are members of the previously selected POs to participate in our household survey. In the following, we explain how we implemented these two stages.

One of the challenges in thinking about a suitable IA design for PRODERI was the level of heterogeneity among treated POs. The M&E data obtained from DIPROSE contain detailed information on the type of project that was supported. Projects were originally distributed into 27 unique sectoral categories (such as agrotourism, horticulture or pig breeding). With the help of technical staff at DIPROSE, the majority of the projects was re-categorized into five main sectors (agro-livestock, apiculture, poultry farming, livestock, and horticulture). The remaining projects, which were not re-categorised, represent 86 of the 445 projects (or 19 per cent) and contain very specific sectoral categories such as aromatics, crafts, or dairy. They were excluded from this IA because they were too rare, not representing the typical PRODERI project.

Thus, after excluding these rare projects as well as those projects conducted in indigenous communities, we obtained the sampling frame for our treatment group, including 307 supported projects. Table 4 shows the distribution of these 307 projects across sector and province. One third of all projects were in the livestock sector, one third in the horticulture sector, and the remaining third was distributed among agro-livestock, apiculture, and poultry sectors. Regarding the geographical distribution of projects in our sampling frame, there is a clear focus of PRODERI in the Northern regions with about 60 per cent of all projects.

Table 4: PRODERI-supported projects by sector and province used for sampling

	Agro-livestock	Apiculture	Poultry	Livestock	Horticulture	Total
Region: Cuyo						
La Rioja	0	0	0	1	3	4
Mendoza	3	1	0	4	18	26
Salta	4	1	0	8	5	18
Region: NEA						
Chaco	4	17	3	15	5	44
Corrientes	6	0	0	3	6	15
Misiones	0	0	5	3	5	15
Region: NOA						
Catamarca	9	0	3	12	10	34
Jujuy	1	1	1	7	7	17
San Juan	3	2	0	3	14	22
Santiago del Estero	1	2	1	11	1	16
Tucumán	1	0	5	10	4	20
Region: Pampas						
Buenos Aires	0	1	0	1	6	8
Córdoba	3	5	1	3	13	25
Entre Ríos	1	4	0	1	3	9
Region: Patagonia						
Chubut	0	0	1	5	2	8
Neuquén	3	0	1	10	1	15
Rio Negro	1	0	1	9	2	13
Total	40	34	22	106	105	307

Unfortunately, there was no registry or census of Argentine POs from which we could have compiled a sampling frame for the control group. We thus developed a sampling frame based on two approaches. First, we relied on a feature of PRODERI in which not all eligible POs that submitted plans for the program were selected. These organizations were rejected largely due to limited implementer capacity and/or funds. However, this control group was not equally distributed across provinces and was not sufficient in numbers to make up the entire sampling frame needed. Therefore, we had to identify additional control group POs that had not submitted business plans for PRODERI

support. We obtained lists of potentially suitable organizations from PRODRI's provincial execution units and through our own network of data collection staff.

The lists of both treated and untreated POs lacked data on the characteristics of these organizations needed for statistical matching of these organizations. Thus, we implemented phone interviews with PO representatives over a period of three weeks in May and June 2021. These interviews collected basic information about the POs, mainly referring to characteristics of these organizations before the program (i.e., in 2012), using a short questionnaire. The exercise intended to collect data for all 307 treated organizations⁶ and all 351 untreated organizations for which we had contact information. In total, 590 organizations could be reached and interviewed, which is a reasonably good response rate. The phone interview data were then combined with secondary data for the first-stage matching, for which we applied nearest neighbor matching. We used a set of variables from the 2010 Population Census publicly available at the Statistics Office website⁷ to control for pre-project characteristics of the community (*localidad*) that can affect selection (such as the share of households with unmet basic needs⁸ or with access to drinking water), as well as a set of geo-referenced variables on rainfall, temperature and vegetation index from various satellite sources.⁹ For an overview of the full set of matching variables and their descriptive statistics, see Garbero et al. (2021).

After having matched treatment and control POs, we randomly sampled 140 treatment organizations and used their first and a random subset of second neighbors as the sample of control organizations. Household and PO level surveys were then implemented with the resulting sample of 270 treatment and control organizations.

The sample size for the household survey was guided by statistical power calculations (see Garbero et al., 2021 for details of the sample size calculation). Six member households per PO had to be selected for household surveys for a total target sample of 1,620 households. Because full member lists of POs were not available, another round of phone calls to all sampled POs were made to request member lists to facilitate random sampling of households.¹⁰ We received member lists of 245 POs, which gave us the final number of households for the survey implementation (1,470). Survey data were then collected between September and November 2021, resulting in a realized final sample of 1,392 households and 233 POs.¹¹

The response rate was of an impressive 100 per cent in six of the 17 provinces (Buenos Aires, Córdoba, Jujuy, La Rioja, Misiones, and Rio Negro). In most of the others, it amounted to between 89 and 99 per cent, which is still considered quite good. Only one province proved to be problematic, which was Chubut in Patagonia with a response rate of 39 per cent. This low response rate is due to the fact that the organizations and households to be interviewed were very dispersed in territory and with limited connectivity to the phone or internet, which often made it impossible to establish contact or retrieve information. The consequence is that our sample does not represent this part of the country very well.

⁶ In fact, the full list of treated organizations for the phone interviews contained 332 treatment organizations. This list of organizations included some indigenous communities that engaged in productive activities targeted by the project and some that did not. The latter were filtered out in the phone survey but the former were included in the interviews given their productive activities.

⁷ <https://www.indec.gob.ar/indec/web/Nivel4-Tema-2-41-135>

⁸ Owing to the lack of nationally representative income and wealth data, calculation of rural poverty is typically conducted using the decennial census (*El Censo Nacional de Población, Hogares, y Viviendas*) using unmet basic needs (NBI) as a proxy for poverty. Households with unmet basic needs are defined as those with at least one the following criteria: (1) inadequate or no housing, (2) insufficient sanitation (i.e. lacking toilet), (3) a number of family members per room exceeding three, (4) at least one child aged 6 to 12 not attending school, and (5) more than four members for each employed person (INDEC, 2010).

⁹ Rainfall data were obtained from CHIRPS (<https://www.chc.ucsb.edu/data/chirps>), temperature from ECMWF (<https://cds.climate.copernicus.eu/cdsapp#!/home>), and vegetation index from MODIS (<https://lpdaac.usgs.gov/products/mod13g1v006/>).

¹⁰ Most of the listing of member households could be completed by telephone, i.e. by calling the same representatives of the POs who had responded to the phone survey. A few representatives would only provide a list when our data collection team contacted them personally in the field.

¹¹ For 1,343 households in the sample (96.5 per cent), there is a corresponding PO interview. For 49 households in the sample (3.5 per cent), the corresponding PO (10 in total) was not interviewed. Some of these cases are treated organizations that were no longer active at the time of the survey. On the other hand, five POs were interviewed, even though there are no corresponding household interviews. These were POs for which a member list could not be obtained ahead of data collection. Our interviewers then contacted the representatives personally when in the field and were able to conduct the organization-level interview even though a member list remained unavailable.

b) Qualitative sample

The sample for the qualitative data collection was purposely designed. The sample was drawn with the aim to represent all five regions of Argentina as well as the five sectors which were also relevant for quantitative data collection (agro-livestock, apiculture, poultry, livestock, and horticulture) as well as the water sector, which was an important target of investment in indigenous communities.

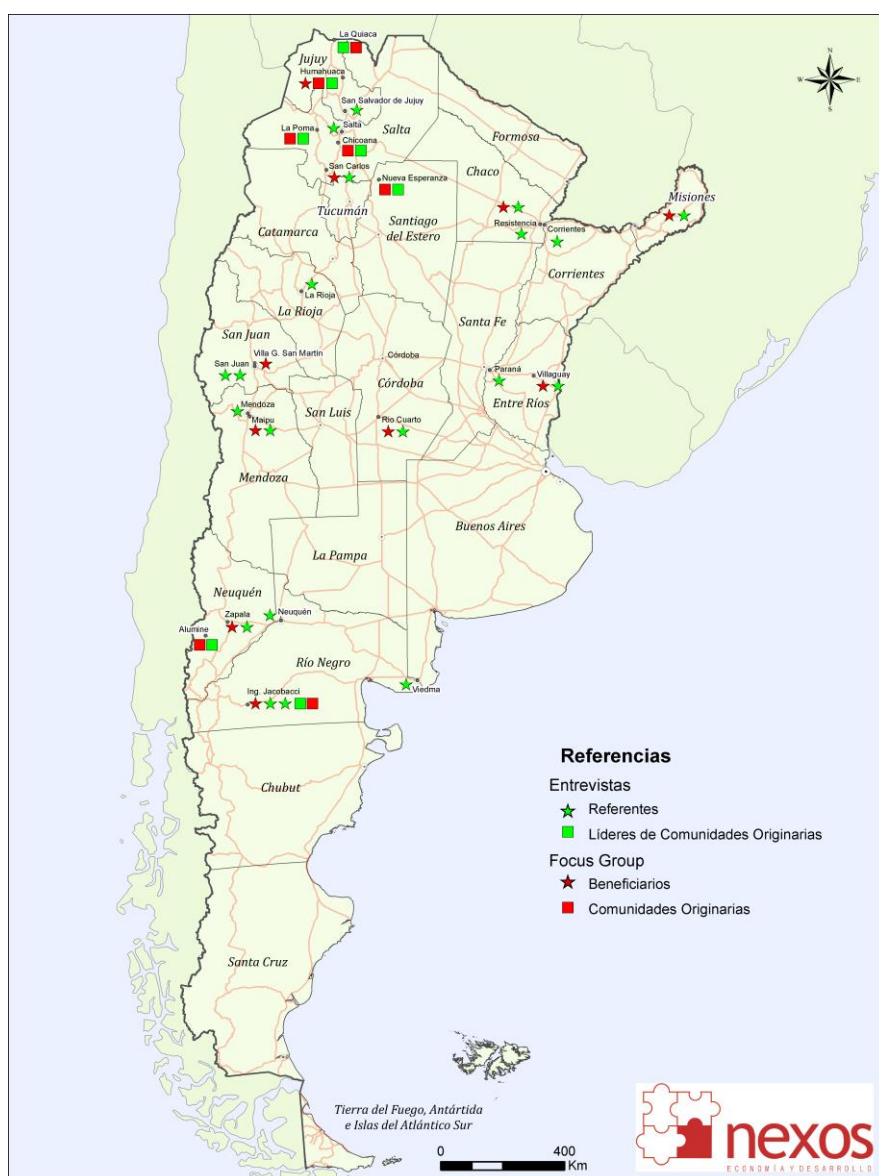
Furthermore, in each region, one KII was conducted with a leader of a PO, a technician, a provincial official or consultant, and an entrepreneur linked to the productive chains that were supported by PRODERI. The KIIs and FGDs with indigenous communities and their leaders were only conducted in NOA and Patagonia, as these are the regions with the largest indigenous populations. With these specifications in mind, we put together a sample of suitable interviewees and focus group participants, relying on our network of interviewers to identify such participants.

Table 5: Overview of qualitative data collection, by region

Region	Producer organizations	Indigenous communities
NOA	4 KIIs: agro-livestock, water, livestock 2 FGDs: agro-livestock, water	5 KIIs: water, apiculture, horticulture 5 FGDs: water, agro-livestock, horticulture
NEA	4 KIIs: apiculture, poultry, horticulture 2 FGDs: apiculture, poultry	
Cuyo	4 KIIs: horticulture, livestock, apiculture, horticulture 2 FGDs: horticulture, livestock	
Pampas	4 KIIs: horticulture, agro-livestock, poultry, apiculture 2 FGDs: horticulture, apiculture	
Patagonia	4 KIIs: livestock, agro-livestock, water 2 FGDs: agro-livestock, livestock	2 KIIs: water, agro-livestock 2 FGDs: livestock, agro-livestock

Qualitative data were collected in May and June 2021. As illustrated in Table 5 and Figure 3, a total of 20 KIIs were conducted with key informants in all five regions of Argentina, and 7 interviews were done with leaders of indigenous communities in NOA and Patagonia. Ten focus group discussions were run with program beneficiaries in each of the five Argentinean regions, and seven FGDs were conducted with indigenous communities in NOA and Patagonia. Table 5 also details the productive sectors from which interview partners and focus groups were recruited.

Figure 3: Geographical distribution of KIIs and FGDs



3.3 Output, outcome, and impact indicators

For the household survey, we deviated from RIA’s standard practice of using the RIA questionnaire template. The primary reason was the fact that we planned to collect data in winter during the COVID-19 pandemic. The necessity to conduct interviews outdoors required us to drastically shorten the questionnaire. Hence, we used a questionnaire version which had been designed at RIA with the aim to be able to measure the standard outcome and impact indicators without conducting the relatively long interviews needed for the standard questionnaire. It was the first time this short questionnaire was used. Median duration of a household interview was 60 minutes.

For the survey of POs, we designed a questionnaire that was driven by PRODERI’s ToC and the above-mentioned research questions. We derived some parts of this questionnaire from previous IAs at RIA where POs were also interviewed. Median duration of an interview with POs was 39 minutes.

Both KIIs and FGDs took a semi-structured approach. For the KIIs, two question guides had been prepared; one for leaders of POs and indigenous communities, technicians, and provincial officials or consultants, and the other for entrepreneurs linked to the productive chains supported by PRODERI. The FGDs were guided by yet another guide of questions. All question guides covered topics of production capacity, commercialization, nutrition and food security, shock resilience, women and

youth empowerment, training and technical advice provided by PRODERI, and management and implementation of the program.

Table 6 provides an overview of the key outcome and impact indicators at household level to be derived from the survey data. Since not all household-level indicators can be calculated for the whole sample, the last column of Table 6 describes for which part of the sample the respective indicator is computed. Table 7 shows a similar overview for additional indicators at PO level. These indicators span the range from outputs over outcomes to impacts.

Table 6: Key quantitative indicators at household level

Indicator	Description	Sample definition
Economic Goal (EG)		
Gross household income	Total gross income is based on the method developed by the team of the Rural Income Generating Activities project, which aggregates value of production plus cash income to make the income of rural households comparable across countries. The sources of income are crop production, livestock production (incl. poultry), apiculture production, self-employment activities, wage employment, transfers (private and public) and other income sources (Davis et al., 2010; Carletto et al., 2007). The per adult equivalent value is divided by the number of per adult equivalent household members.	All households (HHs)
Wage income	Total income from wage employment.	HHs that report to work for wage
Gross agricultural income	Total gross income from crop production, livestock production, poultry production, and apiculture production.	HHs that have agricultural production
Gross self-employment income	Total gross income from self-employment activities.	HHs that report to own a business
Transfer and other income	Total income from transfers (private and public) and other income sources.	HHs that report to receive transfers or other income
Housing assets index	Index of quality of housing characteristics using Multiple Correspondence Analysis and normalized from 0 to 1. Housing characteristics include the quality of walls, roof, floor, toilet facility, type of lighting and source of drinking water.	All HHs
Durable assets index	Index of durable assets calculated using Principal Component Analysis (PCA) and normalized from 0 to 1. Durable assets include freezer, fridge, computer, mobile phone with or without internet access, motorbike and car.	All HHs
Productive assets index	Index of durable assets calculated using PCA and normalized from 0 to 1. Productive assets include truck, tractor, plow, irrigation system, fences for plots, poultry farm, livestock corral and shed.	All HHs

Tropical livestock units	Livestock index created by multiplying the number of animals owned by the livestock unit coefficients for international comparisons (FAO, 2011).	All HHs
Productive capacities (SO 1)		
Total value of agricultural production	Total value of agricultural production includes the total value of crop production (as defined below), the total value of livestock-related production (as defined below), the total value of apiculture production, and the value of income from self-employment from agricultural activities. The value of apiculture production is the quantity of apiculture products (such as honey and bee wax), valued at the market price.	HHs that grow crops, raise livestock, keep bees, or run agricultural business
Total value of crop production	The total value of the harvested quantity of cultivated crops, valued at the market price. Per hectare value is obtained by dividing this value by the total hectares of cultivated land.	HHs that grow crops
Total value of animal-related production	The total value of the production of livestock and poultry and resulting products (meat, milk, eggs, other products). Milk and animal products are valued at the market price, live animals and meat at the sales price. Per TLU value is obtained by dividing this value by the tropical livestock units.	HHs that raise livestock or poultry
Market access (SO 2)		
HH sold any agricultural products	Indicator for whether household sold crops, animal-related products (animals alive, meat, milk, livestock products such as cheese, eggs, or wool), or apiculture products (such as honey or bee wax) in the last 12 months.	HHs that grow crops, raise livestock or poultry or keep bees
HH sold crops	Indicator for whether household sold crops in the last 12 months.	HHs that grow crops
HH sold animal-related products	Indicator for whether household sold animal-related products (animals alive, meat, milk, livestock products such as cheese, eggs, or wool) in the last 12 months.	HHs that raise livestock or poultry
Value of crop sales	Total revenues from sales of all crops in the last 12 months.	HHs that sell crops
Value of animal-related sales	Total revenues from sales of animal-related products (animals alive, meat, milk, products such as cheese, eggs, or wool) in the last 12 months.	HHs that sell livestock or poultry or products derived from these
Share of crop sales in total crop production	Proportion of the value of crop sales in the total value of production of crops in the last 12 months.	HHs that grow crops
Share of animal-related sales in total animal-related production	Proportion of the value of animal-related sales in the total value of production of animal-related products in the last 12 months.	HHs that raise livestock or poultry
Main buyer of crops	A set of indicators for whether the households sells its main crop to a) individual buyers or b) a trader. Main crop refers to the crop with the highest sales value.	HHs that sell crops
Main buyer of animal-related products	A set of indicators for whether the households sells its main animal-related product to a) individual buyers or b) a trader. Main product refers to the product with the highest sales value.	HHs that sell livestock or poultry or products derived from these
Resilience (SO 3)		

Income diversification	Gini-Simpson index of income diversification (from 0 no diversification to 1 full diversification). $GSI = 1 - \sum a_i^2$ where a_i is the share from the i th income source in total income. Income sources considered: wage income, self-employment income, crop income, animal-related income, apiculture income, transfer income (private and public), other income (such as income from properties, investment, savings or assistance from charities).	All HHS
Ability to recover from shock	Indicator for whether the household recovered from shocks at least to the same level as before the shock on average. Variable is reported for climatic shocks (drought, flood, changes in rainy season), non-climatic shocks (crop or animal disease, difficulty to buy agricultural inputs, difficulty to sell agricultural outputs, illness, accident or death of a household member, loss of employment), and all shocks together.	HHS that experienced shocks
Corrected ability to recover from shocks	The mean perceived ability to recover from shocks is corrected for shock exposure, since households do not experience the same types of shocks of the same severity. Variable is reported for climatic shocks, non-climatic shocks, and all shocks together.	HHS that experienced shocks
Food and nutrition security		
Household dietary diversity score (HDDS)	A 0-12 scale index (from 0 low dietary diversity to 12 high dietary diversity) based on the consumption of 12 food groups in the past week (FAO, 2010; Swindale and Bilinsky, 2006).	All HHS
Food insecurity experience scale (FIES)	A 0-8 scale index (from 0 full food secure to 8 full food insecure) based on eight questions regarding food insecurity, also adopted by SDGs (2.1.2) (Saint Ville et al., 2019; Cafiero et al., 2018; Ballard et al., 2013).	All HHS
Household is food secure	Indicator for whether FIES takes a value between zero and three.	All HHS
Household is moderately food insecure	Indicator for whether FIES takes a value between four and six.	All HHS
Household is severely food insecure	Indicator for whether FIES takes a value of seven or eight.	All HHS
Women's empowerment		
Ownership of majority of assets	Indicators for whether either a female alone or a female jointly with a male own most assets of the household.	All HHS
Decision-making in agricultural production	Indicators for whether either a female alone or a female jointly with a male make decisions on agricultural production activities.	HHS that grow crops
Decision-making in livestock rearing	Indicators for whether either a female alone or a female jointly with a male make decisions on livestock production activities.	HHS that raise livestock or poultry
Decision-making on at least one income source	Indicators for whether either a female alone or a female jointly with a male make decisions on at least one source of income.	All HHS

Female has wage income	Indicator for whether at least one female household member earns wage income.	All HHs
PO member is female	Indicator for whether the household member who is a member of the PO is female.	All HHs
Female PO member is part of leadership	Indicator for whether this female PO member is part of the PO's leadership.	HH with female PO members

Table 7: Additional quantitative indicators at PO level

Indicator	Description
Formalization and capitalization	
Legal status	Indicator for whether PO has legal status.
By-laws	Indicator for whether PO has written by-laws.
Accounting books	Indicator for whether PO maintains accounting books.
Bank account	Indicator for whether PO has a bank account.
Access to loans	Indicator for whether PO applied for loan in the last three years.
Funding for working capital	Indicator for whether PO used external funds for financing working capital in the last three years. External funds are loans, grants, and donations.
Funding for investments	Indicator for whether PO used external funds for financing investments in the last three years. External funds are loans, grants, and donations.
Female and youth empowerment	
Share of female members	Proportion of females among all members of the PO.
Share of youth members	Proportion of youth (aged 18-29) ¹² among all members of the PO.
Share of female leaders	Proportion of females among all leaders of the PO.
Share of youth leaders	Proportion of youth (aged 18-29) among all leaders of the PO.

3.4 Impact estimation

This IA relies on ex-post quasi-experimental methods for the identification of PRODERI's impact. These methods necessitate the construction of a valid counterfactual group ex-post, i.e., at the end of a program. In PRODERI's case, the identification of a counterfactual group is complicated by self-selection into treatment and the endogenous determination of treatment activities. Therefore, the expected value of an outcome variable for treated and untreated groups cannot be simply compared, i.e.:

$$E[Y_{0i}|D_i = 1] \neq E[Y_{0i}|D_i = 0], \quad (1)$$

where Y_{0i} is the outcome of interest, such as income or food security, of individual i , and D_i defines the treatment status for individual i . As a result, the naïve comparison of members of treated to untreated groups will return a biased estimate of the treatment effect, $E[Y_{1i} - Y_{0i}]$. In order to obtain an unbiased estimation of the impact of PRODERI, we must identify a counterfactual group that does not introduce selection bias or for which $E[Y_{0i}|D_i = 1] = E[Y_{0i}|D_i = 0]$ can be satisfied conditional on a vector of observed covariates, X_i . To identify this group, this study utilizes statistical matching,

¹² This age range for youth was defined by the program. Note that it is different from the official UN definition of youth, which is aged 15-24.

which assumes that the only source of selection bias is a set of observed covariates (Rosenbaum & Rubin, 1983). This is the key identifying assumption of the matching estimator, also called the conditional independence assumption. The conditional independence assumption states that potential outcomes are independent of treatment status:

$$E[Y_{ji}|X_i, D_i] = E[Y_{ji}|X_i], \text{ for } j = 0, 1. \quad (2)$$

This implies that the average treatment effect (ATE) can be estimated as follows:

$$ATE = E[Y_{1i} - Y_{0i}] = E\{[Y_{1i}|X_i, D_i = 1] - [Y_{0i}|X_i, D_i = 0]\}. \quad (3)$$

Therefore, the ATE is calculated simply by averaging X -specific differences between treatment and control, then reweighting using the marginal distribution of X_i . Matching estimators are most effectively employed when the researcher has a detailed and thorough understanding of the selection process, as their accuracy is conditioned on the inclusion of relevant variables driving selection (Angrist and Pischke 2008). Moreover, for confidence in the matching estimator, a plausible case must be made for selection on observables.

We estimate the Average Treatment Effect on the Treated (ATET), which was identified as a cornerstone method (Imbens and Wooldridge, 2009), when both treated and untreated groups are only observed post-treatment. The ATET is formally defined as:

$$ATET = E(Y_{1i} - Y_{0i}|D = 1). \quad (4)$$

The ATET is usually of more policy interest than the ATE, because it reports how the treatment affected those who actually participated, rather than how it may have affected others (Frölich and Sperlich 2019).

PRODERI was implemented federally, each province defined its own selection criteria for PDTs, and decisions were made by CASTs in each province. Moreover, implementers only considered those organizations that chose to submit proposals for inclusion in the program. In order to participate in the program, organizations must have been aware of the program, then decide that the expected benefits of the program exceeded the costs of participation, and then have the desire, time, organizational capacity, and wherewithal to formulate a business plan. Not only can we not observe or construct the utility function through which POs evaluated the benefits of the program; we also cannot observe their human resource and financial capacities, time and other factors that may have driven the decision to submit a business plan. We, therefore, have to assume that we correctly modelled the process driving selection into treatment with the characteristics measured in the phone survey as well as community-specific variables on well-being and climate. For this first round of matching, we employed 3-nearest neighbor propensity-score matching (PSM).

At the final analysis stage, we then engage in a second round of PSM to match treated and untreated households to create the best counterfactual for the estimation of the household level treatment effect. We estimate the ATET using the IPWRA model and conduct robustness checks using nearest neighbor matching.¹³ The matching variables include household composition, household head characteristics, household wealth, short- and long-run climate characteristics, and community characteristics (Appendix 1 provides the full list of matching variables).¹⁴ Matching diagnostics indicate that treated and control households are well balanced after PSM matching (Appendix 1). The remaining differences between control and treatment households are not statistically significant and the standardised mean differences are always less than 0.1 as recommended by Austin (2009). In the course of matching, we identify and drop 21 treated households, which are not on common support. Hence, the final sample used to estimate impacts covers 1,371 households.

The IPWRA is a doubly robust estimation approach that models both the outcome and selection equations (Wooldridge, 2007, 2010). The IPWRA uses the inverse-probability weights (IPW) from the estimation of the predicted probability of receiving treatment to account for the missing data problem

¹³ For the nearest neighbor matching, we rely on the five nearest neighbors. Results are not included in this report but can be requested from the authors.

¹⁴ For some outcome variables, we had to rely on a smaller set of matching variables than those shown in Appendix 1 because the IPWRA calculation would not have converged otherwise. This was generally the case for those outcome variables that are defined over a smaller than the full sample, for example, amounts of income obtained from different income sources, value of sales, or the likelihood to sell on the market. We dropped the two indicators for whether the household grows crops or keeps livestock or poultry from the set of matching variables. Additionally, we had to combine the two indicators for living in Pampas or Patagonia into one indicator because the sample is quite small in Patagonia, which created issues for convergence.

arising from the fact that each household is only observed in one of the potential outcomes (Hirano et al., 2003). In the case of ATET, the IPW is computed as:

$$IPW_{ATET} = t + \frac{p(X)(1-t)}{1-p(X)}, \quad (5)$$

where t is defined as the treatment status and $p(X)$ as the estimated propensity score. All treatment households are assigned a weight of one, while control households are weighted by the inverse of this score, meaning that households that are more similar to a treatment household are assigned a higher weight. Using the computed IPW, a weighted regression model is then used to estimate the predicted value of the outcome for the treatment and the control group. The regression model is specified as follows:

$$y_i = \alpha + \beta t_i + \gamma X_i + \delta(X_i - \bar{X})t_i + \varepsilon_i \quad (6)$$

where y_i is the outcome for household i , t_i is the treatment status for household i , X_i is the matrix of control variables and γ is the respective vector of coefficients to be estimated for each of the control variables, β is the coefficient of the treatment indicator, α is the constant and ε_i is the error term. The model is estimated using ordinary least squares for continuous outcome variables, probit for binary outcome variables, and a fractional logit for variables that capture a proportion. Standard errors are always clustered at the PO level. The control variables in the matrix X_i are factors that are expected to influence the outcome variable, while not having been affected by the program (the full list of variables in the selection and outcome equations are presented in Appendix 2). The ATET is then calculated as the difference between the predicted value of y for the treatment and control groups.

In addition to identifying household level effects, we also compute impact estimates for organization-level output, outcome, and impact indicators where relevant as indicated in the ToC. We compute ATET estimates using nearest neighbour PSM. The matching variables are identical to those used in the first round of matching of POs mentioned above. Two of the 233 POs are out of common support, and we thus report impact estimates for a maximum of 231 organizations.

4. Profile of the project area and sample

4.1 Characteristics of sample producer organizations

The survey among POs includes data from 233 organizations, of which 116 benefitted from PRODERI and 117 did not.¹⁵ The sampled POs are spread across all 17 provinces in which the program was implemented. Yet, in line with the geographical focus of PRODERI, most POs in our sample are in the two Northern regions, i.e., NOA and NEA (154 in total). Among the remaining ones, 35 are in Cuyo, 31 in Pampas, and 13 in the Patagonia region. The two Northern regions are quite poor: All eight provinces in these regions that participated in PRODERI have an above average share of households with unmet basic needs (INDEC, 2010). Ramilo and Prividera (2013) describe the family farmers in NOA as the most undercapitalized stratum of family farmers with highly precarious living conditions.

Table 8 shows selected characteristics of the POs in our sample. We asked the respondents, in which agricultural sectors the organization was engaged, with multiple answers possible. We did not allow for agro-livestock as an option but let the respondents list livestock and another type of agriculture separately. The most frequent sectors are horticulture and livestock, which account for about three fifths of the POs each. Apiculture and poultry are sectors that are much less common; only about one tenth of organizations are active in each of these. Treated organizations are less likely to engage in horticulture (52 vs. 67 per cent) and livestock (60 vs. 64 per cent) than control organizations and more likely to be active in apiculture (13 vs. six per cent) and poultry farming (11 vs. eight per cent).

The number of members in the interviewed POs varies widely, from six to 1,500.¹⁶ The mean number of members is 83 for treated and 89 for control organizations. The average number of leaders, which are either the members of a governing body (if one exists) or rather informal representatives, is 8.2 for treated and 8.6 for control organizations; hence, one tenth of the mean number of members. Again, the range is wide, from zero to 90.

The respondents were asked to report which services the PO offers to its members.¹⁷ Again, multiple answers were allowed. We obtain some interesting insights in this regard. First, the majority of organizations (75 per cent of treated and 69 per cent of control) offer capacity building and training to their members. This is the most common service provided. Second, all services are offered by more treated than control organizations on average, and this difference is statistically significant in some cases, such as maintenance and rental of machinery, marketing services, soil preparation, sales, storing, bulking, and credit, microcredit or rotating funds. The majority of these services may be directly linked to PRODERI. For example, the program put a lot of emphasis on commercialization; it is thus not surprising that more treated than control organizations engaged in marketing services (43 vs. 27 per cent) and sales (35 vs. 24 per cent).¹⁸ Furthermore, the PRODERI-fund FOCO provided working capital to the organizations. This capital was often lent as loans to the members or distributed as rotating funds. This may, at least partly, explain why more treated than control organizations provide credit, microcredit or rotating funds (33 vs. 20 per cent). Assuming that the observed differences were indeed due to PRODERI, we could conclude that the program had a lasting influence on the services provided

¹⁵ We here describe the characteristics of all 233 POs even though we will run impact estimates below for only 231 POs. Given that we compute estimates at the PO level for a limited number of indicators only, we preferred to keep the entire PO sample in this sub-section to provide a complete picture of POs. In the case of describing households in the following sub-section, however, we already exclude those that are out of common support.

¹⁶ In fact, there was one PO with a reported number of zero members in our sample. According to the respondent, this organization was not active at the time of the survey. Whenever we knew ahead of the survey that an organization was no longer active, we did not conduct a PO interview.

¹⁷ The list of services provided was elaborated with insights from the phone survey. In the phone survey, we had also asked about services offered (at baseline). We received numerous answers in the "other, specify" category that was allowed for. These answers helped us to improve the list of services for the final survey.

¹⁸ The difference between marketing services and sales may not be obvious. We provided instructions to the interviewers that sales implies that POs sell the products of their members for them. Marketing services, in contrast, includes such activities as organising markets where producers can sell their products themselves or linking producers with potential buyers in other ways.

by POs. This follows from the fact that we asked about services provided at the time of the interview, not during program implementation.

In terms of productive assets owned by POs that are available to their members, we see that around one third of the organizations own a tractor, a warehouse for stockpiling or processing, or a water tank. Slightly more than one fifth own a milling machine or a refrigerator. All other infrastructure is owned by a smaller proportion of organizations. There are not many differences between treated and control organizations. In fact, the only differences are in the ownership of vehicles. More treated than control organizations own a tractor (41 vs. 21 per cent) or a truck (four vs. one per cent), and fewer treated than control organizations own a motorbike (four vs. 11 per cent).

Table 8: Selected characteristics of producer organizations

Variable	Treated		Control		Difference (T-C)
	Mean	Obs.	Mean	Obs.	
Sector of engagement (%), multiple sectors possible:					
- Horticulture	51.7	116	66.7	117	-15.0**
- Livestock	60.3	116	64.1	117	-3.8
- Apiculture	12.9	116	6.0	117	6.9*
- Poultry	11.2	116	7.7	117	3.5
Number of members	82.6	116	89.1	117	-6.5
Number of leaders	8.2	116	8.6	117	-0.4
Services provided to members (%), multiple services possible:					
- Capacity building, training	75.0	116	69.2	117	5.8
- Input purchase	49.1	116	39.3	117	1.8
- Maintenance and rental of machinery	47.4	116	34.2	117	13.2**
- Marketing services	43.1	116	26.5	117	16.6***
- Soil preparation	40.5	116	23.9	117	16.6***
- Sales	35.3	116	23.9	117	11.4*
- Storing	34.5	116	23.1	117	11.4*
- Bulking	34.5	116	22.2	117	12.3**
- Credit, microcredit, rotating fund	32.8	116	19.7	117	13.1**
- Transporting	25.9	116	17.1	117	8.8
- Curing, preserving or processing	18.1	116	16.2	117	1.9
- Quality assessment, certification and labelling	17.2	116	10.3	117	6.9
- Packaging	15.5	116	11.1	117	4.4
Ownership of productive assets (%), multiple items possible:					
- Tractor	41.4	116	23.1	117	18.3***
- Warehouse for stockpiling/processing	37.1	116	27.3	117	9.8
- Water tank	32.8	116	32.5	117	0.3
- Milling machine	24.1	116	21.4	117	2.7
- Refrigerator	20.7	116	22.2	117	-1.5
- Barnyard/stockyard	16.4	116	17.1	117	-0.7

Variable	Treated		Control		Difference (T-C)
	Mean	Obs.	Mean	Obs.	
- Storage facility	11.2	116	10.3	117	0.9
- Irrigation	9.5	116	12.8	117	-3.3
- Livestock house	8.6	116	4.3	117	4.3
- Poultry house	8.6	116	6.0	117	2.6
- Truck	4.3	116	0.8	117	3.5*
- Motorbike	4.3	116	11.1	117	-6.8*

Note: The difference reported in the last column is the mean in the treatment group minus the mean in the control group. The stars indicate results of a t-test for continuous variables and of a Chi-squared test for binary variables. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level, respectively.

4.2 Characteristics of sample households

The household survey data that we use for the below impact estimation contain information from 1,371 households. All of them are members of a PO. The frequency of PO services used by the households (Table 9) mirrors the frequency of services provided by the POs as shown above. Capacity building and training, maintenance and rental of machinery, and input purchase are the services most often used; in contrast, quality assessment, certification and labelling, curing, preserving and processing, and packaging are rather rarely used services. For several of the services, there are statistically significant differences between treated and control households. In general, treated households are more likely to use the services provided by their PO than control households. The starkest differences are for maintenance and rental of machinery (32 vs. 17 per cent), soil preparation (22 vs. 14 per cent), and bulking (17 vs. 9 per cent).

The households in our sample have relatively low economic standards of living. Median annual gross income (for the period October 2020 to September 2021) amounts to ARS 621,030 (equivalent to USD 6,862)¹⁹, which translates to ARS 51,752 (equivalent to USD 572) per month or ARS 1,701 per day (equivalent to USD 19).²⁰ Gross income per adult equivalent per day is ARS 727 (equivalent to USD 8.03).²¹ Monthly net household income at the 2019 national poverty line (updated by inflation to June 2020) was ARS 43,288 (Global Living Wage Coalition, 2020).²² The Anker Living Income Reference Value for 2020 was calculated to be ARS 50,023 per month. This value is for net income and specifies “the income required by rural families to afford a basic but decent living standard in a typical rural area of Argentina” (Global Living Wage Coalition, 2020: 2). Considering high inflation of 51 per cent in 2021 (INDEC 2021b) and the difference between net and gross income, our average sample household cannot ensure this basic but decent living standard, even if it may not qualify as poor according to the national poverty line. Treated households are better off in terms of annual gross income than control households: They have a median income of ARS 684,390 (equivalent to USD 7,562) compared with ARS 558,400 (equivalent to USD 6,170) for the control group. This difference is not due to larger household size in the treated group; in fact, average household size does not differ between treated and control households.

¹⁹ We use an exchange rate of 90.5 ARS per USD. This is the average exchange rate for the period October 2020 to September 2021, which is roughly the time period covered by the questions in our household survey. We extracted daily exchange rates from the website of the Argentinean Central Bank and calculated the mean for the 12 months in question.

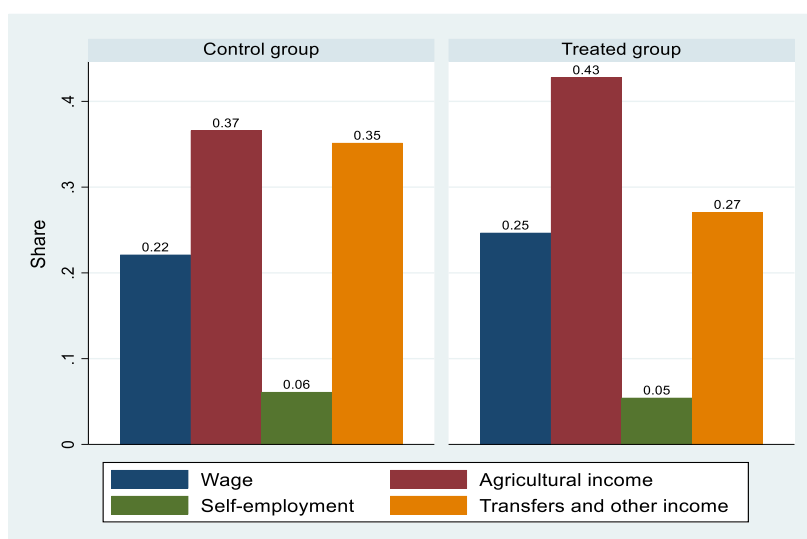
²⁰ Note that the exchange rate of 90.5 ARS per USD used throughout this report is the official exchange rate. Yet, real prices and income are better reflected by the so-called “blue dollar”, which is an unofficial rate in Argentina. The blue dollar is the cost of buying and selling a physical dollar bill in a clandestine financial house in Buenos Aires. The blue dollar rate for the time period in question is 162.75 ARS per USD, as calculated from monthly rates on <https://bluedollar.net/informal-rate/>. Using this blue dollar rate, gross income per adult equivalent per day is USD 4.47, rather than USD 8.03.

²¹ We trimmed outliers in all the monetary outcome values, i.e. income, value of production, and value of sales, as well as in the tropical livestock units. We trimmed 2 percentiles both at the lower and upper end for income and only at the upper end for production, sales, and tropical livestock units.

²² It has to be noted that the situation and extent of rural poverty in Argentina is not well understood. Argentina is the only country in the Latin America and the Caribbean region without a nationally representative poverty survey. The *Encuesta Permanente de Hogares*, which is used to calculate nearly all national poverty statistics, is only deployed in urban areas and only representative of approximately 6.3 out of every 10 residents (World Bank, 2018).

The largest component of household income is agricultural income (Figure 4), which may be income obtained from crop production, livestock, poultry, or bee keeping and any products obtained from livestock, poultry, or bees. This amounts to about 40 per cent of total income. By far the smallest component is income from self-employment, with only five to six per cent of the total. Wage income and income from transfers and other sources make up for between one quarter and one third of income. In almost half of the sample households, at least one member has wage employment. Income shares are statistically significantly different between treated and control households for agricultural income (43 vs. 37 per cent) and transfers and other income (27 vs. 35 per cent). In absolute terms, there is a statistically significant difference in wage income and agricultural income. For both sources, treated households have higher income than control households: ARS 440,117 (USD 4,863) vs. ARS 381,399 (USD 4,214) for wage and ARS 459,969 (USD 5,083) vs. ARS 343,896 (USD 3,800) for agricultural income.

Figure 4: Share of income from different sources



Asset ownership among our sample households is moderately low. Considering an asset index normalized to range between zero and one, treated households have an average score of 0.36 for durable assets (compared with 0.34 in the control group), 0.15 for productive assets (0.10 in the control group), and 0.34 for the quality of housing (0.35 in the control group). The average value of Tropical Livestock Units is 1.79 among treated households and 1.78 among the control group. None of these differences, except for productive assets, are statistically significant, indicating that treated households are very similar to control households in terms of asset ownership.

Despite the low economic living standards of the households in our sample, they do not seem to suffer from malnutrition or food insecurity, at least not measured by indicators used here. As Feenay and MacClay (2016) describe, Argentina does in fact suffer from several nutritional problems, including undernutrition, anemia, and overweight. Yet, in terms of our indicators, we see that the average HDDS is 10, indicating that an average household consumed 10 food groups out of the 12 food groups considered for the calculation of this score²³ in the seven days prior to the survey. Similarly, the average household experienced between one and two types of food insecurity, out of a maximum of eight considered for the FIES indicator.²⁴ Nevertheless, 21 per cent of our sample households are moderately or severely food insecure (as defined in Table 6).

As seen above, our sample households rely to a large extent on agricultural income. About 50 per cent of the sample are engaged in crop production, almost two thirds in animal production (livestock and poultry), and roughly 10 per cent in bee keeping. Note that households may engage in several of these

²³ These 12 food groups are as follows: cereals; tubers and roots; vegetables; fruits; meat; eggs; fish and seafood; legumes, nuts or seeds; milk and milk products; oils and fats; sweets; spices, condiments and beverages.

²⁴ These values indicate that our sample households have a high level of dietary diversity and food security in comparison with households in neighbouring Bolivia (Paolantonio et al., 2018; Cavatassi and Gemessa, 2021). This better situation in terms of nutrition is not surprising given that Argentina is classified as an upper middle-income country, and the values are comparable to that of Peru – another upper-middle-income country (Arslan et al. 2020).

activities. The main crops grown are maize, pumpkin, alfalfa, cassava, and different vegetables, such as lettuce, tomato, pepper, and onion. The main animals raised are cattle, goats, sheep, pigs, and chicken. Bee keeping households mostly produce honey; some also produce wax or other products. Given that bee keeping is a rather infrequent activity and quite different from the rest, we do not consider this group of households separately in calculating impacts, for example on production values or sales values. A surprisingly large share of 12 per cent of the sample (11 per cent of treatment and 13 per cent of control) did not engage in crop, livestock, poultry, or bee production at the time of the survey. These households had nevertheless been sampled and interviewed, as they are members of the sampled POs.²⁵

Among those households with crop, livestock, poultry, or bee production, treated households had annual agricultural production worth ARS 653,577 (equivalent to USD 7,222), compared with ARS 496,001 (equivalent to USD 5,481) for control households. This difference is statistically significant, and it is reflected in the value of production of crops (ARS 650,213 vs. ARS 487,378) or animal-related products (ARS 281,755 vs. ARS 230, 878) alone. When we calculate productivity measures, namely the value of crop production per hectare of cultivated land and the value of animal-related production per TLU, treated households still have higher production than control households, but these differences are no longer significant. Notably, treated households have much more land than control households: average land size is 477 hectares vs. 305 hectares for all households, i.e., including those without any land, or 578 hectares vs. 394 hectares for those households with land (unreported in Table 9). The size of cultivated land is drastically lower at 5.2 hectares for treated and 3.9 hectares for control households. This huge difference to the overall size of land is because crop growing households have much less land than livestock or poultry raising households (31 hectares vs. 482 hectares), and only a share of land owned by crop growing households is cultivated.

One of the main goals of PRODERI was to increase sales of household production. Ninety and 81 per cent of treated and control producers, respectively, sold at least part of their agricultural production in the market in the 12 months prior to the survey. Among crop growers alone, these shares are 67 and 61 per cent, and among animal keepers alone, 83 and 73 per cent. Not only do more animal producers than cropping households sell their produce; they also sell a higher share of their production, namely 85 per cent, compared with only 48 per cent for crops. For those households that do sell, the value of sales for crops is higher than for animals. The average value of crop sales is ARS 391,326 (equivalent to USD 4,324) for treated households and ARS 311,070 (equivalent to USD 3,437) for control households. For sellers of animal-related products, average sales are worth ARS 209,805 (equivalent to USD 2,318) for treatment and ARS 167,884 (equivalent to USD 1,855) for control. These differences in sales values are statistically significant.

Treated and control households are similarly diversified in income. The Gini-Simson index of income diversification, which ranges from zero to one, amounts to 0.39 on average. Quite surprisingly, treated households are less able to recover from shocks. While 17 per cent of treated households had recovered from shocks experienced in the last 12 months by the time of the survey, 24 per cent of control households reported to have recovered. The corrected ability to recover index also suggests that treated households have a lower ability to recover (2.08 for treatment and 2.17 for control). This pattern is reflected both for climatic and non-climatic shocks.

Table 9: Selected characteristics of households

Variable	Treated		Control		Difference (T-C)
	Mean	Obs.	Mean	Obs.	
Household size (per adult equivalent)	3.52	685	3.51	686	0.01
Household head is female (%)	24.53	685	30.32	686	-5.79**
Household head is married (%)	70.51	685	68.37	686	2.14
Household head is indigenous (%)	21.02	685	22.01	686	-0.99
Age of household head	51.14	685	51.27	686	-0.13

²⁵ In fact, this membership was confirmed during the interview. There was a screening question right at the beginning of the questionnaire, which asked for whether someone in the household was or at least had been a member of the respective PO. If respondents negated this, the interview was stopped immediately.

Variable	Treated		Control		Difference (T-C)
	Mean	Obs.	Mean	Obs.	
Head has no or incomplete primary education (%)	13.87	685	17.06	686	-3.19
Head has complete primary education (%)	55.62	685	57.14	686	-1.52
Head has complete secondary education (%)	21.02	685	17.78	686	3.24
Head has complete tertiary education (%)	9.49	685	8.02	686	1.47
Hectares of land owned	477	685	305	686	172
Hectares of land cultivated	5.20	365	3.89	334	1.31
Portion of land is irrigated (%)	73.15	365	76.05	334	-2.9
Tropical livestock units	11.43	667	10.45	672	0.98
Travel time to next 5-10k city in minutes	70.71	685	70.23	686	0.48
Household grows crops	53.28	685	48.69	686	4.59*
Household raises animals (livestock or poultry)	61.61	685	63.56	686	-1.95
Household keeps bees	12.70	685	9.18	686	3.52**
Usage of PO provided services					
- Capacity building, training	44.23	685	40.38	686	3.85
- Maintenance and rental of machinery	31.82	685	17.35	686	14.47***
- Input purchase	25.26	685	22.74	686	2.52
- Marketing services	23.50	685	17.35	686	6.15***
- Soil preparation	22.34	685	13.70	686	8.64***
- Storing	17.37	685	12.54	686	4.83**
- Credit, microcredit, rotating fund	17.08	685	17.49	686	-0.41
- Sales	16.93	685	18.66	686	-1.73
- Bulking	16.79	685	9.18	686	7.61***
- Transporting	11.82	685	6.41	686	5.41***
- Quality assessment, certification, labelling	9.34	685	6.71	686	2.63*
- Curing, preserving, processing	9.34	685	5.54	686	3.80***
- Packaging	6.86	685	5.54	686	1.32
Economic Goal					
Gross household income	867,446	659	718,009	651	149,437***
Gross household income, per adult equivalent	295,664	659	234,643	651	61,021***
Housing assets index	0.34	685	0.35	686	-0.01
Durable assets index	0.36	685	0.34	686	0.02
Productive assets index	0.15	685	0.10	686	0.05**
Tropical livestock units	1.79	667	1.78	672	0.01

Variable	Treated		Control		Difference (T-C)
	Mean	Obs.	Mean	Obs.	
Productive capacities (SO 1)					
Value of agricultural production	653,577	601	496,001	592	157,576***
Value of crop production	650,213	358	487,378	327	162,835**
Value of crop production per hectare	274,244	358	198,934	327	75,310
Value of animal-related production	281,755	412	230,878	429	508,77**
Value of animal-related production per TLU	38,665	391	30,797	415	7,868
Market access (SO 2)					
HH sold any agricultural products (%)	90.15	609	81.48	594	8.67***
HH sold crops (%)	66.58	365	61.38	334	5.20
HH sold animal-related products (%)	83.18	422	73.39	436	9.79***
Value of crop sales	391,326	237	311,070	202	80,256*
Value of animal-related sales	209,805	345	167,884	311	41,921**
Share of crop sales in total crop production	0.49	365	0.46	330	0.03
Share of animal-related sales in total animal-related production	0.85	409	0.85	408	0.00
Resilience (SO 3)					
Income diversification	0.40	659	0.38	651	0.02
Ability to recover from shock (%)	17.32	537	23.58	530	-6.26**
Ability to recover from climatic shock (%)	16.52	454	20.13	457	-3.61
Ability to recover from non-climatic shock (%)	17.36	363	27.24	323	-9.88***
Corrected ability to recover (all shocks)	2.08	537	2.19	530	-0.11**
Corrected ability to recover (climatic)	2.04	454	2.13	457	-0.09
Corrected ability to recover (non-climatic)	2.08	363	2.23	323	-0.15***
Nutrition and food security					
Household dietary diversity score	10.10	685	9.95	686	0.15*
Food insecurity experience scale	1.62	685	1.51	686	0.11
Women's empowerment					
Decision-making on agricultural production: female only	16.71	365	19.46	334	-2.75
Decision-making on livestock rearing: female only	18.25	422	22.94	436	-4.69*
PO member is female	29.20	685	39.80	686	-10.6***
Female PO member is part of leadership	36.00	200	28.21	273	7.79*

Note: The difference reported in the last column is the mean in the treatment group minus the mean in the control group. The stars indicate results of a t-test for continuous variables and of a Chi-squared test for binary variables. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level, respectively.

As the information collected in our KIIs and FGDs reveals, a central problem for the producer households prior to the implementation of PRODERI was lack of water for own consumption, irrigation, and animal consumption. Many households live in arid and semi-arid areas, or in areas with strong climatic variation. Having regular water supply is thus essential for their production processes, both crop growing and animal breeding. In addition to rainwater, which is scarce in many areas, most households obtained water from canals, wells, ponds, reservoirs, or in some cases from submersible pumps. However, this water is often of poor quality due to turbidity levels or arsenic and agrochemical contamination and physically difficult to catch.

Furthermore, many households reported to have lacked the economic resources to buy materials or finance activities such as shearing, sowing, or other productive needs. They found it difficult to sustain themselves in times of low production, and they did not have access to credit from formal public or private financial systems. They often relied on loans from other people or organizations. Without credit, however, producers had limited capacity to invest and improve production, both individually and collectively.

The lack of infrastructure and equipment for production was another limiting factor. Households rarely had the mechanical tools that would have allowed them to save time and work (tractors, power tillers, seeders, etc.), so many depended on horses, oxen, or mules to work on their plots of land. Infrastructure was also very limited, especially corrals, wire fences, sheds, greenhouses, anti-hail nets and other infrastructure or equipment for production and processing.

4.3 COVID-19 pandemic

This IA was strongly affected by the COVID-19 pandemic in several ways. First and foremost, the pandemic resulted in a substantial delay of the study: Even though the scoping mission to Argentina had taken place in March 2020, actual data collection did not start until one year later. This delay was due to the general uncertainty around whether and how to continue any activities that involved travel and social contacts, which was experienced by governments, companies, and international organizations around the world in the first year of the pandemic.

When we initiated data collection in 2021, the COVID-19 pandemic complicated field work substantially. Qualitative data collection was particularly affected, as it was supposed to take place at the beginning of the second quarter of 2021. This was the time when the epidemiological situation in Argentina worsened dramatically, with the peak in the number of confirmed cases experienced in the second half of May (WHO, 2022). During this time, it was impossible to hold any in-person meetings. We had to wait for better health conditions and for travel and meeting restrictions to be lifted before we could start inviting people to KIIs, FGDs and survey interviews.²⁶ Only a few KIIs were conducted over the phone; all other data collection exercises took place in person with the necessary precautions in place, such as meeting outdoors whenever possible, keeping distance between persons, wearing masks, etc.²⁷

The delay in data collection has substantial consequences, as any measurement of impact indicators does not only measure the impact of PRODERI but ultimately the impact of PRODERI and the pandemic. The economic impact of COVID-19 in Argentina has been significant. GDP declined by 10.2 per cent in the third quarter of 2020 compared with the same period of the previous year. The economy has been recovering since then, and GDP grew by 11.9 per cent in the third quarter of 2021 compared with the same quarter of 2020. This recovery has not included the agricultural sector, however, which had negative growth of its sectoral GDP in this period (INDEC, 2021a). Nevertheless, our IA findings would be only affected by the pandemic to the extent that it affected the treated and control households in a systematically different way. Our careful sample design and analysis methodology, using matched

²⁶ Given that travel and meeting restrictions were set up at the province level, we could work in some provinces earlier than others.

²⁷ The training for the surveys was split into a virtual part and an in-person part. The virtual part consisted in three days of online sessions and covered a presentation of the survey instruments as well as of the survey software. The following in-person part was held at three different locations to reduce the number of contacts and included mock interviews and a pilot test of the two surveys.

treatment and control households, minimize the possibility of systematic differences to influence our estimated impacts.

We included a number of questions in our questionnaire that aim at assessing the extent to which households were exposed to and affected by COVID-19. From these, we generate several indicator variables that illustrate the way how households experienced the pandemic in their livelihoods. In Table 10, we present descriptive statistics for these variables for treated and control households. Around half of the households in our sample reported a decrease in at least one income source since the beginning of the pandemic, and two fifths of the households noted that their agricultural production activities (for crops, livestock, poultry, or apiculture) decreased in the 12 months prior to the survey. Much fewer households (15-16 per cent) reported that they had to sell livestock or poultry to deal with COVID-19, and very few (one to two per cent) sold durable or productive assets. For none of these four variables was there a statistically significant difference between treated and control households, which supports the above argument that they were similarly affected. Nonetheless, treated households were more likely to judge their own situation in life at the time of the survey to be worse than at the beginning of the pandemic (this difference is significant at the 10 per cent level).²⁸ Given that we do not find a statistically significant difference between the groups in terms of income sources, assets or agricultural production activities, which are the main impact indicators in this study, we posit that the difference in subjective wellbeing reported should not have significant bearing on impact estimates.

We nevertheless create a COVID exposure index through PCA based on the variables in Table 10 and include it in the list of covariates in the IPWRA regressions to control for any potential impact of remaining differences between the two groups. The index is normalized to be between zero and one.

Table 10: Exposure to and effect of COVID-19 on the sample households

Variable	Treated		Control		Difference (T-C)
	Mean	Obs.	Mean	Obs.	
Durable or productive assets were sold in last 12 months to deal with COVID-19 (%)	2.2	685	1.5	686	0.7
Livestock or poultry was sold in last 12 months to deal with COVID-19 (%)	16.1	685	14.7	686	1.4
Agricultural production activities were affected by COVID-19 in last 12 months (%)	39.1	685	38.9	686	0.2
Income from at least one source decreased since beginning of pandemic (%)	51.2	685	47.7	686	3.5
HH perceives a decrease in its life situation since beginning of pandemic (%)	30.1	685	25.4	686	4.7*

Note: The difference reported in the last column is the mean in the treatment group minus the mean in the control group. The stars indicate results of a t-test for continuous variables and of a Chi-squared test for binary variables. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level, respectively.

4.4 Inflation in Argentina

Argentina has been experiencing high inflation repeatedly over the last decades, and the last three years have again seen dramatic increases in prices. Annual inflation has been constantly above 30 per

²⁸ The way this was asked follows the standard Cantril ladder of subjective wellbeing questions. We told households: "Imagine a ladder with steps numbered from 0 at the bottom to 10 at the top. Imagine that the lowest step 0 represents the worst possible life for you and your household, and the highest step 10 represents the best possible life for you and your household. A) On which step of the ladder would you say your household stood in January 2020? B) On which step of the ladder would you say your household stands now?" See also <https://news.gallup.com/poll/122453/understanding-gallup-uses-cantril-scale.aspx>

cent since mid-2018 (Trading Economics, 2022). According to the *Instituto Nacional de Estadística y Censos* (INDEC, 2021b), which is the national statistics office, the consumer price index rose by 50.9 per cent in 2021.

Inflation of such a magnitude was quite a challenge for the management and implementation of PRODERI, as became clear in our KIIs and FGDs. All development projects had been formulated by the POs with the assumption of a certain level of prices for inputs and outputs. However, after the projects were approved and disbursements made, the money received by the POs was no longer worth the same and was often insufficient to purchase the envisioned goods and services. This then implied the suspension or only partial realisation of investments, an accelerated search for new sources of financing to finalise any works in progress, or the suspension of activities linked to training and technical assistance.

The high increase in consumer prices was also worrisome for our survey that attempts to collect information on such variables as household income. Questions in our household questionnaire on income from different sources simply refer to the last 12 months prior to the interview. Households could report income amounts as they recorded them, and we assume that this was usually the amount obtained when the money was received. We do not assume that households adjusted any inflows from a few months ago to their current value given inflation.

In principle, it would be ideal to calculate the net present value for any monetary values based on when exactly money was received. However, our interest is not to correctly measure the magnitude of income over a certain time; it is to assess the impact of PRODERI on its beneficiaries as compared to the counterfactual. Thus, as for the case of COVID-19, to the extent that treated and control households were equally affected by inflation, it would not be a threat to our IA. Equal effect requires a similar composition of income and, even more importantly, a similar timing of any monetary flows. Importantly, if treated and control households obtained income from the same source over several months in the year of interest, we either want them to have similarly stable income flows across months or that variation over time was similar. We thus included a few questions in our questionnaire that recorded the following aspects for most components of income:²⁹

- a) in how many of the last 12 months income was received,
- b) if received in more than one month, whether income was stable over these months, and
- c) if it was not stable, in which month was the highest income received.

In Table 11, we illustrate the distribution of a) and b) for the sale of agricultural products, which are the most important income components for our study. While there are some differences in the number of months in which crops and milk were sold across treated and control households, this is not problematic as long as income was relatively stable over the months. For all five categories of agricultural products, a relatively small share of households (and these are only those with sales in more than one month) reported that income was not stable across the months in which sales were made. Additionally, only in the case of apiculture products was there a significant difference between treated and control households. Yet, income from apiculture makes up for only two per cent of total household income and six per cent of agricultural income and is thus a marginal source of income. We consider this situation acceptable in terms of inflation and do not correct the monetary values reported but simply add up income from the different components as it was reported.

Table 11: Stability of agricultural sales over time

Variable	Treated		Control		Difference (T-C)
	Mean	Obs.	Mean	Obs.	
Crop sales					
- Number of months	3.4	426	4.0	398	-0.6**
- Income unstable (%)	22.5	262	17.3	278	5.2
Animal sales					
- Number of months	5.0	250	4.9	232	0.1
- Income unstable (%)	28.8	170	25.0	156	3.8

²⁹ In fact, we did not ask these questions for income components that we consider to be stable over time despite inflation. These are wages and public transfers.

Variable	Treated		Control		Difference (T-C)
	Mean	Obs.	Mean	Obs.	
Milk sales					
- Number of months	5.6	19	9.9	23	-4.3***
- Income unstable (%)	29.4	17	18.2	22	11.2
Sale of animal-related products					
- Number of months	5.4	162	5.6	144	-0.2
- Income unstable (%)	18.2	110	21.6	97	-3.4
Sale of apiculture products					
- Number of months	5.3	69	6.2	55	-0.9
- Income unstable (%)	14.3	56	32.5	40	-18.2**

Note: The difference reported in the last column is the mean in the treatment group minus the mean in the control group. The stars indicate results of a t-test for continuous variables and of a Chi-squared test for binary variables. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level, respectively.

5. Results

In this section, we present the estimated impacts of PRODERI on the household-level indicators listed in Table 6 as well as PO-level indicators shown in Table 7. We enrich the quantitative findings with insights from our KIIs and FGDs, which help to interpret several of our estimates and to identify some of the channels through which impact may have been realized.

The tables reporting impacts include four columns: the first column shows the outcome or impact indicator, the second column the estimated impact of the program, the third column the control mean, which is the potential outcome mean (POM), and the fourth column the number of observations. The POM indicates the potential outcome treated households would have had, had they not benefited from the program. The estimated impact is reported as per cent or percentage point change compared to the POM.³⁰ Since we calculate the ATET, the estimated impact is the average change within the beneficiary population. We present the full household-level estimates of IPWRA in Appendix 3. When not explicitly stated, the results are robust for IPWRA and nearest neighbor matching, the latter of which is not included in this report. Note that we excluded projects funded by PRODERI in indigenous communities that focused on water infrastructure as well as projects that were rather untypical for the program. Hence, the impact estimates only refer to the included list of project activities mentioned in Table 4.

Most outcome and impact indicators refer to the 12 months prior to the survey, which – depending on the date of interview – were the 12 months starting in September, October, or November 2020. Monetary values are reported in local currency and current values.

5.1 Overall impacts of PRODERI for the key indicators

a) Economic mobility (economic goal)

PRODERI had an impact on gross household income and on gross agricultural income (Table 12). Gross household income for the treatment group is significantly higher than that for the control group by 16 per cent (equivalent to an increase of ARS 88,590 or USD 979). The increase was 17 per cent (ARS 30,089 or USD 332) when income is measured in per adult equivalent terms. Though this increase is substantial, it may be less than what was specified in the log-frame of PRODERI: the program's objective was to raise income of 80 per cent of the beneficiary households by 30 per cent (IFAD, 2011). When comparing our impact estimates to the objectives in the log-frame, it is important to keep in mind that the latter refer to the project's contribution to change for its beneficiaries without controlling for all other factors that contribute to the change. The impact estimates, on the other hand, refer to the program's impact that is directly attributable to its interventions controlling for all other factors, and hence the two are not directly comparable.

When looking at income from agricultural activities (i.e., crop growing, livestock raising, poultry farming, bee keeping), treated households have a much larger income (42 per cent) compared with the control group. This corresponds to an increase of approximately ARS 66,556 (or USD 735) that is attributable to PRODERI. Furthermore, treated households receive 22 per cent higher income from wage employment (equivalent to ARS 50,156 or USD 554), but this result is only marginally statistically significant. We have unfortunately only limited information on wage employment in our survey data; for example, we do not know whether employment is in the agricultural sector or outside. This makes it difficult to interpret the finding, but it seems that beneficiary households free up family labor, which is then employed elsewhere. Possible explanations are that physical investments made possible by PRODERI make agricultural activities less labor intensive; training provided by PRODERI makes the trained people more attractive as employees; or value added to agricultural production

³⁰ The interpretation of the ATET coefficient has to take into account the different construction of the impact variable. When the impact variable is the logarithmic transformation of a continuous variable (e.g. monetary value or kilogrammes of production), the ATET coefficient is interpreted as per cent change of $[\exp(ATET) - 1] * 100$. When the impact variable is a binary variable that assumes the value of one or zero (e.g. 1 if the household used an input and 0 otherwise), the ATET coefficient is interpreted as the change in percentage points, i.e. the percentage difference between the treated group and the control group. When the impact variable is a score or index value, the ATET coefficient is divided over the potential outcome mean to convert the impact into per cent change.

generates employment at the local level.³¹ Another possible explanation is implied in our qualitative data. It is reported that many of the projects, especially those including water or other infrastructure, required the contracting of companies to realize the work. Yet, experiences were not always positive because of issues of compliance and quality of the work. Thus, POs sometimes assumed the tasks, which allowed them to generate local employment. The program did not significantly affect income obtained from self-employment and transfers and other sources.

Table 12: PRODERI impact on economic mobility

	Impact		Control Mean	Observations
Gross household income ⁽¹⁾	15.73	**	563,192	1310
Gross household income, adult equivalent ⁽¹⁾	16.84	**	178,675	1310
Wage income ⁽²⁾	22.10	*	226,950	640
Gross agricultural income ⁽²⁾	41.70	***	159,607	1135
Gross self-employment income ⁽²⁾	-7.06		138,320	267
Transfer and other income ⁽²⁾	-9.23		164,803	987
Housing assets index	6.34		0.32	1371
Durable assets index	-10.42		0.40	1371
Productive assets index	33.78		0.11	1371
Tropical livestock units ⁽²⁾	3.58		2.82	1339

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

When looking at income shares, it turns out that PRODERI led to a five per cent higher and a seven per cent lower share in income obtained from agriculture and transfers and other sources among treated households, respectively (Table 13). The latter result is particularly interesting, as it suggests that treated households are less dependent on welfare benefits or other support payments due to the program; the share of this kind of income decreased significantly. Indeed, the majority of income from transfers and other sources are governmental transfers: Income from pensions makes up 53 per cent in total transfer and other income for treated and 55 per cent for control households, and income from governmental assistance amounts to 37 per cent for treated and 39 per cent for control households.

Table 13: PRODERI impact on income shares

	Impact		Control Mean	Observations
Share of income from wage in total income	1.49		0.23	1310
Share of income from agriculture in total income	4.63	**	0.38	1310
Share of income from selfemployment in total income	-0.18		0.06	1310
Share of transfer and other income in total income	-6.73	***	0.34	1310

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

³¹ It is interesting to note that PRODERI's log-frame specified that 15,000 jobs should be created.

Surprisingly, the impacts of PRODERI on all three asset indices are not statistically significant (Table 12), which implies that there is no significant difference between treated and control households' asset ownership that can be attributed to the program.^{32,33} One possible explanation for the lack of impact on assets is that the increase in income was not large enough to allow for major investments. Inflation may be an important factor in this regard. For the case of productive assets, there is another possible explanation, namely that there is no need to invest in such assets as households can access these through their PO. To see if this latter explanation is reasonable, we tested for differences in access to productive assets across treated and control households using household-level data. In Table 14, we show that for most of the assets listed, treated households are more likely to access them through their PO than control households. For example, 29 per cent of treated households access tractors owned by their PO, but this share is only 17 per cent for control households. This result is not surprising given that more treated than control organizations own tractors (see Table 8), and these may have been purchased with PRODERI funding. However, we also find that treated households are more likely than control households to access warehouses for stockpiling or processing (17 vs. 11 per cent), water tanks (14 vs. 10 per cent), barnyards (14 vs. five per cent), or milling machines (12 vs. seven per cent), for which there was no significant difference in ownership by POs. This finding could be interpreted in several ways: treated households may be more aware of the productive assets their POs own, possibly because they actively applied for investment funding from PRODERI; they may have received more or better training in how to use these assets; or the productive assets owned by the treated POs may be in a better state due to better maintenance.

Table 14: Access to productive assets at PO level by member households

Variable	Treated		Control		Difference (T-C)
	Mean (%)	Obs.	Mean (%)	Obs.	
Tractor	29.2	685	17.6	686	11.6***
Warehouse for stockpiling/processing	17.5	685	10.9	686	6.6***
Water tank	14.0	685	10.2	686	3.8**
Barnyard/stockyard	13.6	685	5.2	686	8.4***
Milling machine	12.1	685	7.1	686	5.0***
Irrigation	5.3	685	5.0	686	0.3
Storage facility	3.6	685	6.3	686	-2.7**
Livestock house	4.1	685	2.2	686	1.9**
Refrigerator	2.9	685	3.8	686	-0.9
Poultry house	3.2	685	2.9	686	0.3
Truck	2.0	685	1.3	686	0.7
Motorbike	0.3	685	1.5	686	-1.2**

Note: The difference reported in the last column is the mean in the treatment group minus the mean in the control group. The stars indicate results of a t-test for continuous variables and of a Chi-squared test for binary variables. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level, respectively.

b) Productive capacities (SO1)

As suggested by the results in Table 15, PRODERI had a substantial impact on household production. The treated group has between 52 per cent and 92 per cent higher production values (for overall

³² Note that the result for productive assets and durable assets is sensitive to the estimation method. The ATET estimated using nearest neighbor matching is positive and statistically significant at the five per cent level for the productive assets index and negative and statistically significant at the 10 per cent level for the durable assets index.

³³ The log-frame of PRODERI clearly specified that PRODERI should increase the assets of 60 per cent of the beneficiary households, but it did not quantify by how much (IFAD, 2011).

agricultural production, crop production – absolute and per hectare – as well as animal-related production) compared with the control group, and this difference can be attributed to the program. Treated households experience an increase of ARS 107,217 (equivalent to USD 1,185) in the value of total annual agricultural production as a consequence of PRODERI. The increase is ARS 88,058 (equivalent to USD 973) for the value of crop production and ARS 42,327 (equivalent to USD 468) for the value of animal-related production. This finding indicates that the attributable impacts of the program on production were higher than the expected contribution effects (25 per cent) defined in the log-frame (IFAD, 2011).

Table 15: PRODERI impact on productive capacities

	Impact		Control Mean	Observations
Value of agricultural production ⁽²⁾	74.32	***	144,264	1193
Value of crop production ⁽²⁾	91.79	***	95,934	685
Value of crop production per hectare ⁽²⁾	51.70	**	67,969	685
Value of animal-related production ⁽²⁾	72.32	*	58,527	841
Value of animal-related production per TLU ⁽²⁾	34.35		8,206	806

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

If we consider the possible mechanisms that could have produced this positive result, it was emphasized in the KIIs and FGDs that the water infrastructure established by PRODERI was an important factor for increasing production, both of crops and animals. For example, one program technician reports of a community which previously had no water management system, which meant that all production was carried out on dry land and animals had to be moved every few days to access water. With the PRODERI investment, it became possible to provide water for crop irrigation and animals with positive effects on the volume of production. This investment allowed the community to set up planting sites, which also improved the diversity of production. Even though it was not explicitly stated, it is possible that improved water supply also led to time savings as was also found in other contexts (ESA Consultores International, 2003; Walker et al., 1999).

Furthermore, our KII participants mentioned that the acquisition of farm infrastructure (such as wire fences, corrals, and greenhouses), machinery (tractors), and inputs (beehives, small tools, etc.) using PRODERI funding has also been fundamental to increase production, improve the organization of production and reduce working time, thus increasing production efficiency. They report that saving time has allowed for diversifying productive activities and thus for improving incomes. They furthermore explain that more pasture allowed a considerable increase in meat production; the acquisition of bees and beehives increased honey production; and the creation of sheds to produce chicken and eggs considerably increased yields and volumes.

To obtain some additional insights on the channels through which PRODERI may have helped the beneficiary households in increasing their production, we ran an impact estimation for the use of the 13 PO-provided services listed in Table 8. We obtain a statistically significant result only for the maintenance and rental of machinery. PRODERI increased the use of this service by 12 percentage points.

c) Market access (SO2)

Increasing access to the market for the producers of the supported POs was a key objective of PRODERI, as indicated in the ToC (Figure 1). Given the characteristics of the producers and the precariousness of their living and working conditions, achieving market access was quite a challenge, as became clear in our qualitative interviews and FGDs. Not all producers are interested in commercialisation of their products. Instead, for some of them, the main objective is own consumption.

Evidence on the impact of PRODERI on market access is mixed (Table 16). On the one hand, the program led to a 9.5 percentage point increase in the likelihood that households sell any agricultural products.³⁴ This increase is strongly driven by an increase in the likelihood to sell animal-related products rather than crops. On the other hand, among those households that sell their produce in the market, there is no difference between treated and control households in the value of sales that can be attributed to PRODERI. The program did also not affect the share of crop or animal-related sales in the total production of crops or animals and animal products, respectively. Neither did the program change the nature of buyers.

It is somewhat surprising that even though treated households were induced by the program to produce more agricultural products than control households, the value of sales among treated households that sell their products does not differ from the value of sales of the control group. This may indicate that treated households do not sell a larger quantity of their products and instead use the additional produce for own consumption.³⁵ Our data provide supporting evidence for this explanation as the total value of annual home consumption of agricultural produce is significantly higher for treated compared with control households (ARS 130,893 vs. ARS 108,947). Alternative explanations could be that treated households do not add more value to their produce and/or do not obtain better prices than the control households. Unfortunately, in our survey data, it is not possible to get a clear idea about value added to agricultural products. Nevertheless, the qualitative information suggests that there has, in fact, been a strong development of food processing, in some cases through dehydration, in others in the form of production of preserves, sweets, liqueurs, cider or sausages. There is also evidence in Table 14 that treated households accessed warehouses at the PO level for stockpiling and processing to a significantly larger extent than control households, and in Table 9 that treated households were more likely than control households to use curing, preserving and processing services provided by their PO.³⁶ Hence, even though we do not have information on how much of any processed goods were sold or consumed, we conclude that the lack of value added among treated households does not appear to be the reason for a missing impact on the value of sales.

Table 16: PRODERI impact on market access

	Impact	Control Mean	Observations
HH sold any agricultural products	9.49 ***	0.81	1203
HH sold crops	3.88	0.62	697
HH sold animal-related products	10.45 ***	0.73	858
Value of crop sales ⁽¹⁾	6.02	130,029	437
Value of animal-related sales ⁽¹⁾	7.12	97,102	656
Share of crop sales in total crop production	3.74	0.46	695
Share of animal-related sales in total animal-related production	-0.44	0.85	817
HH sells main crop to individual buyers	-0.50	0.53	446
HH sells main crop to trader	-0.54	0.25	446
HH sells main animal-related product to individual buyers	-2.95	0.68	670
HH sells main animal-related product to trader	2.58	0.25	670

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in

³⁴ The magnitude of this effect may need to be interpreted in the context of the COVID-19 pandemic. Since our period of reference was a pandemic year, it could be that the impact of PRODERI on the likelihood to sell outputs looks smaller than it was in non-pandemic times. Access to markets is likely the dimension most affected by the COVID-19 pandemic.

³⁵ Possibly, treated households stored more produce and could thus consume it over a longer period of time. Unfortunately, we have no information on storage at home. For storage at the PO, we see in Table 14 that treated households did not access storage facilities at the PO level more than control households. However, treated households reported to use storing services provided by their PO more than control households (Table 9). As mentioned above, we ran an impact estimation for the use of storing services and get statistically insignificant results. Hence, PRODERI does not seem to have increased storage at the PO.

³⁶ We also ran an impact estimation for the use of curing, preserving and processing services. PRODERI did not significantly increase the use of these services.

Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

The mixed results on the impact of PRODERI on market access need to be seen in the context of varying technical capabilities in the provinces and the prevalence of weaknesses in many POs (IFAD, 2019). As became clear in our KIIs, the POs with more experience with rural development programs and those that have had more stable technical assistance from technicians or consultants over time, were able to make progress in consolidating market linkages and to create new opportunities for cooperation. In contrast, POs that are more remote, with few previous market linkages, and with little technical assistance as well as indigenous communities that primarily benefitted from investments in water infrastructure have usually not been able to link up with more (formal) actors and organizations, thus remaining more dependent on their local markets and links, which are often of a clientelist nature. Thirty-five per cent of treated POs and 21 per cent of control POs engaged in selling the produce of their members. Yet, there is no statistical difference between these treated and control POs in the number or type of buyers.

The role of provincial and local governments turned out to be critical to improve commercialization processes. When local governments supported the POs and made physical spaces (such as for fairs) available or helped to solve bureaucratic, sanitary, and connectivity barriers, commercialization processes were activated and generated multiple opportunities for producers. These factors imply that some producers in PRODERI-supported POs are likely to have experienced a marked increase in market access and participation, while nothing is likely to have changed for others. Such heterogeneities are hidden in the overall impact estimates portrayed in Table 16 as our sample unfortunately does not allow for producing results on heterogeneous impacts at such level of detail.

The interviews and FGDs revealed three key factors that continue to limit any commercialization. The first factor is the low connectivity, as there is no mobile phone signal and hence access to the internet in many places. Many POs are remote, which prevents them from establishing lasting work networks or more innovative marketing mechanisms. The second factor relates to the long distances between many remote places and the urban centers and the poor state of many roads, impassable in rainy seasons. This is a serious problem in many areas of the country, but especially in NOA and Patagonia. In addition, most producers do not have a van or a car and therefore have to pay for a taxi or other service to get to marketplaces. The third limiting factor is the high level of informality of the producing households, especially when it comes to commercialization agreements. Many producers are not registered, but there seems to be an impact of PRODERI on their formalization. The program increased the likelihood that households were registered with the *Administración Federal de Ingresos Públicos* (AFIP) by five percentage points from a POM of 20 per cent. Registration with AFIP constitutes a high degree of formalization of the productive activity carried out by the producing household³⁷, and new opportunities may open up for marketing and for establishing more stable commercialization links.

d) Resilience (SO3)

PRODERI intended to increase households' resilience to shocks, though we do not find a statistically significant increase in income diversification and ability to deal with shocks (Table 17). In contrast, the results suggest that the program may instead have decreased households' ability to recover from shocks. We report results for six variables that measure the ability to recover: the first three are dummy variables indicating whether the household reported having recovered from a shock (to the same level or above), and the last three are exposure corrected measures of ability to recover (continuous variables). Treated households are six percentage points less likely to recover from non-climatic shocks, and their exposure corrected ability to recover is six and eight per cent lower for all shocks and non-climatic shocks, respectively, compared with control households. The nearest neighbor matching results point even more to a negative impact. Here, the estimated coefficients are statistically significant at least at the 10 per cent level for five of the six indicators. Note that all these indicators are defined only for households that experienced a shock, which are 78.4 per cent among treated households and 77.3 per cent among control households. Income diversification is a resilience indicator that captures household resilience capacity and is defined for all households.

³⁷ Registration can either be as so-called *monotributista* or as *responsable inscripto*. The first option is a simplified category for paying taxes. Among our sample households, the majority of those that are registered are *monotributistas*.

Table 17: PRODERI impact on resilience

	Impact	Control Mean	Observations
Income diversification	1.41	0.39	1310
Ability to recover from shock	-4.91	0.22	1067
Ability to recover from climatic shock	-3.68	0.20	911
Ability to recover from non-climatic shock	-5.70 *	0.23	686
Corrected ability to recover (all shocks)	-6.07 **	2.21	1067
Corrected ability to recover (climatic shocks)	-3.42	2.12	911
Corrected ability to recover (non-climatic shocks)	-8.12 ***	2.27	686

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

The findings on resilience are in contrast to insights from the qualitative data, which suggested increased resilience, especially vis-à-vis climatic shocks, for beneficiary households. Improvements in resilience were not only expressed by program beneficiaries, but also by technicians, provincial officials, consultants, and entrepreneurs linked to PRODERI. Our interview participants provided several arguments for why resilience was perceived to have increased as a result of the program. The increase in productive assets (such as farmyards), the uptake of certain agricultural practices (such as to set aside seeds for future seasons), or a diversification of productive activities were mentioned to allow for greater productive capacity and higher income generation. The increase in resilience was also seen to be a product of a rise in the social and organizational capital of the beneficiaries. PRODERI reportedly improved the capacity of households to organize themselves and to generate new initiatives, processes or management practices that would allow them to overcome crisis situations.

Despite this subjective impression of increased resilience, the quantitative impacts estimated show no attributable impact. To shed more light on why there may be no or even a negative impact of PRODERI, we provide descriptive statistics on shock experience and the extent of recovery for treated and control households in Table 18. It needs to be stressed that exposure to shocks as well as ability to recover are subjective perceptions, subject to measurement error. Drought is by far the most frequent shock reported, followed by difficulties to access inputs, changes in the rainy season, crop or animal diseases and pests, and difficulties to sell outputs. Floods and loss of non-agricultural employment are least frequently reported, the latter of which may be due to a low prevalence of non-agricultural employment in the sample.³⁸ The fact that floods are not frequently experienced, even though they have been shown to create substantial asset losses in Argentina (Rozenberg et al., 2021), can be explained with their geographical concentration, in our sample in the two provinces of Buenos Aires and Chaco.

While there is no major difference between treated and control households in the likelihood to experience any of the three climatic shocks (drought, flood, change in rainy season), there are significant differences for three of the non-climatic shocks. While 36 per cent of treated households report to have had difficulties to access inputs, this was the case for only 31 per cent of control households. Similarly, 22 per cent of treated households mentioned difficulties to sell their produce, but only 18 per cent of control households did so. In contrast, more control than treated households were affected by illness, accident, or death of a household member (10 vs. seven per cent). The fact that more treated than control households report difficulties to purchase inputs as well as to sell outputs may be an indication that they are more market-oriented, as partly also seen in Table 16. The greater market orientation may make them more sensitive to perceiving and reporting these shocks measured by subjective indicators.

Among households that experienced a shock, the majority had not recovered to at least the same level as before the shock by the time of the survey; and this is true for all types of shocks that we enquired about. However, treated households are even less likely than control households to have recovered.

³⁸ While our data reveal that at least one household member is wage employed in 49 per cent of the households, we have unfortunately no information about whether this is in agriculture or not.

Following drought, crop or animal disease or pests, difficulties to access inputs, and difficulties to sell outputs, significantly more treated than control households report that they have not recovered or have recovered somewhat but are still worse off than before. Hence, even if the KIIs and FGDs suggested that PRODERI beneficiaries are more resilient to and better able to deal with shocks compared to before the project, they are less likely than control households to report these in response to selected shock types as captured by the survey data. A possible explanation may be the greater market orientation of treated households, as indicated above, and the fact that treated households obtain a larger share of their income from agriculture is also likely to make them more susceptible to perceiving and reporting exposure to these shocks.³⁹

Table 18: Shock experience and recovery

Variable	Treated		Control		Difference (T-C)	
	Mean	Obs.	Mean	Obs.		
Household experienced shock in last 12 months (%)						
- Drought	59.42	685	58.31	686	1.11	
- Flood	4.09	685	5.83	686	-1.74	
- Change in rainy season	27.45	685	25.36	686	2.09	
- Crop/animal disease or pest	21.75	685	20.85	686	0.90	
- Difficulty to access inputs	36.06	685	31.20	686	4.86*	
- Difficulty to sell outputs	22.34	685	18.37	686	3.97*	
- Illness, accident or death	7.15	685	10.20	686	-3.05**	
- Loss of non-agricultural employment	3.36	685	3.35	686	0.01	
Household did not recover or recovered but is worse off than before (%)						
- Drought	88.45	407	83.25	400	5.20**	
- Flood	92.86	28	85.00	34	7.86	
- Change in rainy season	75.53	188	77.59	174	-2.06	
- Crop/animal disease or pest	89.26	149	81.82	143	7.44*	
- Difficulty to access inputs	85.43	247	78.50	214	6.93*	
- Difficulty to sell outputs	90.20	153	75.40	126	14.80***	
- Illness, accident or death	63.27	49	67.14	70	-3.87	
- Loss of non-agricultural employment	82.61	23	86.96	23	-4.35	

Note: The difference reported in the last column is the mean in the treatment group minus the mean in the control group. The stars indicate results of a t-test for continuous variables and of a Chi-squared test for binary variables. *, **, & *** represent statistical significance at the 10%, 5%, & 1% level, respectively.

e) Nutrition and food security

Another objective of PRODERI was to improve the nutritional status and food security of producer households. To be precise, the log-frame of PRODERI determined that half of the beneficiary households in indigenous communities should improve their food security (IFAD, 2011). Such an improvement can either be achieved by improving the quality, quantity and diversity of food produced

³⁹ Yet another possible explanation may be differential timing of shocks. The survey captured any shocks experienced in the 12 months prior to the survey. In principle, it could thus be that control households experienced shocks earlier within these 12 months than treated households and thus had more time to have recovered by the time of the survey. We consider this explanation as rather unlikely though, not least because of the way our counterfactual was designed. At least for covariate, i.e. climatic, shocks, the level of exposure and timing should be similar across treatment and control. In principle, this could be verified using objective measures through georeferencing, but this is out of the scope of this analysis.

by the households themselves or by increasing household income from the sale of products or services and thus facilitating the purchase of a higher quality, quantity, and diversity of food.

According to the qualitative information we collected in a sample of indigenous communities, many households perceived that the consumption and quality of food improved substantially. Due to PRODERI-funded investments in water infrastructure or greenhouses, many households reported that they can now prepare their own gardens and harvest a wide variety of vegetables (such as lettuce, tomatoes, peas, squash, carrots) and fruits (such as melons, watermelons). They also report that they can better store their produce, which makes food available over a longer period. The focus groups in indigenous communities emphasize that the increased access to water substantially improved their health and quality of life.

An additional interesting insight from the qualitative data is that the creation of home gardens triggered a new way of producing and exchange of products between members of POs and with neighbors. Producers often began to harvest seeds and exchanged them for other seeds or products with other producers, which revalued local seeds and created a strong awareness of the more sustained production of local genetic material.

Keeping in mind that the survey data do not cover many projects in indigenous communities by design, we present the estimated impacts of PRODERI on food security and nutrition indicators for the treated households in our sample in Table 19. We find that PRODERI did not have an attributable impact on the nutritional status or food security of our sample households. Neither the HDDS nor the FIES differs significantly between treated and control households. Also, the program did not have an impact on the likelihood to be either food secure or – moderately or severely – food insecure. This seeming contradiction to the picture conveyed by the qualitative data needs to be interpreted carefully. The survey data capture the impact for the full sample interviewed in our survey. While there are households who identify as indigenous in our survey sample, they make up for only 21 per cent. Hence, the quantitative and qualitative evidence may provide two aspects of the same situation.

In fact, the missing overall impact can likely be explained with the fact that the households in our sample (both treated and control) do quite well in terms of nutrition and food security, even without the program, as we had already seen in Table 9. With such a high level of dietary diversity and food security prevalent, not much improvement is possible, even if households are able to produce more kinds of vegetables or fruits as suggested above.

Table 19: PRODERI impact on nutrition and food security

	Impact	Control Mean	Observations
Household dietary diversity score	-0.28	10.13	1371
Food insecurity experience scale	-1.39	1.64	1371
HH is food secure	0.72	0.78	1371
HH is moderately food insecure	-1.96	0.17	1371
HH is severely food insecure	-0.17	0.07	1371

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

5.2 Contribution of PRODERI for the additional indicators

a) Women's empowerment (mainstreaming theme) and youth

An important objective of PRODERI was the empowerment of women and youth. We investigate different aspects of this objective at the household level and at the PO level. In terms of women's empowerment within their households, Table 20 reports several indicators. PRODERI did not lead to more women (either alone or jointly with a male) owning most household assets or making decisions on productive activities or the use of income. In contrast, the likelihood that women own most household assets jointly with men decreased by six percentage points. Similarly, the likelihood that

women take decisions on agricultural production jointly with men decreased by 10 percentage points and that they alone decide on the use of income decreased by 5 percentage points because of the program. Please note that these results are not entirely robust to the specification. Results from nearest neighbor matching only show a significant decrease in women's decision-making on the use of income, not for the other indicators. These findings are an indication that the development projects funded by PRODERI supported productive activities that may have favoured men slightly more than women. Further evidence for such an interpretation is the fact that PRODERI reduced the likelihood that the household member who is a member of the PO is a female by six percentage points. However, in those households where a female is the PO member, the program increased the likelihood for her to be part of the PO leadership by 10 percentage points.

Table 20: PRODERI impact on women's empowerment

	Impact	Control Mean	Observations
Ownership of assets: majority by			
- Only female	-0.46	0.17	1371
- Jointly with man	-5.76 *	0.47	1371
Decision making on agricultural production			
- Only female	0.28	0.17	699
- Jointly with man	-9.83 **	0.28	699
Decision making on livestock rearing			
- Only female	-2.06	0.21	858
- Jointly with man	-3.01	0.35	858
Decision making on the use of earnings from at least one income sources			
- Only female	-4.73 *	0.42	1371
- Jointly with man	-0.50	0.44	1371
At least one female is wage employed	1.55	0.19	1371
PO member from the household is female	-6.13 **	0.35	1371
Female PO member is part of leadership	10.32 **	0.26	473

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

PRODERI clearly stated the need for women's participation in the planning and implementation of the funded development projects. According to our KIIs and FGDs, this demand was seen by many POs and indigenous communities as a redundant imposition by PRODERI. It was stated that the participation of women is not a protocol to be complied with for them, but a natural element of their organization or community. In this sense, they felt that there was an over-emphasis on gender issues that did not correspond with the local reality. In many projects, the females reportedly led the productive and organizational processes.

As detailed by our interview participants, the participation of women in the PRODERI-funded projects and especially in their formulation was of crucial importance for the future of the rural territories. While men often focused on the description of productive activities or the creation of infrastructure, women considered the importance of the planned development projects for the maintenance of the rural families and their quality of life. They wanted to ensure that the projects generated conditions that would offer a good life to their children, giving them a perspective to remain in the area and to not have to migrate.

Such a perspective for young people to remain in the rural area is clearly important to guarantee youth participation and empowerment. It was reported that young people stay in or even return to rural areas when they see that their parents engage in productive activities on their own farms and that working conditions, especially the availability of water, improve. As also observed in other studies (for example, Sili et al., 2016), there was greater participation in the PRODERI-funded projects of young

people who study or have studied in technical or agricultural schools than of youth who do not have an agricultural education.

Technological change and internet access were key factors for the involvement of young people, not only because technology offers new opportunities to young people in rural areas, but also and especially because the young understand and can manage new production and communication technologies. Thus, in some cases it was the young people who formulated the business plans that were then submitted for PRODERI funding.

With the help of our survey data, we measure the impact of PRODERI on the empowerment of females and youth in the interviewed POs (Table 21).⁴⁰ The proportion of women among all PO members is quite high; the control mean is 35 per cent. Yet, the program did not have a significant impact on this proportion. The share of females among all leaders is even higher. The control mean for this indicator amounts to 40 per cent, but the program seems to have had a negative impact of seven percentage points. This finding is unexpected given our finding in Table 20 that the program increased the likelihood for women to be leaders. In fact, 74 per cent of treated POs have at least one woman among their leadership. This is way beyond the objective of PRODERI to ensure women's participation in leadership positions of 23 per cent as specified in the log-frame and attests to the disconnect between local reality and project log-frame indicators (IFAD, 2011). We see this as additional evidence for the argument brought forward by the interviewed POs that women's participation is status quo for them and not something that needs to be enforced by any program. Still, contrary to what treated POs report in the qualitative interviews, there seems to be a margin of improvement relative to control POs. It might be that the firm starting position of treated POs in terms of female participation led to an under-effort in this area. The share of youth members, as defined by the program (i.e., aged 18-29), was negatively affected by the program. PRODERI reduced the share of youth among all members by six percentage points. It did not change the share of youth leaders though.

Table 21: PRODERI impact on women and youth empowerment in POs

Variable	Impact	Control Mean	Observations
Share of female members (%)	-0.03	0.35	231
Share of youth members (%)	-0.06 **	0.21	230
Share of female leaders (%)	-0.07 *	0.40	226
Share of youth leaders (%)	0.02	0.13	226

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results are from nearest neighbor PSM. For binary outcomes, the control mean corresponds to a share. Impact on binary outcomes is expressed in percentage points.

b) Training and technical advice

In our household survey, we asked the respondents whether they had received any kind of technical assistance or training for their agricultural activity or enterprise since the beginning of 2013, i.e., roughly the start of PRODERI. As spelled out in the program's ToC, the hypothesis was that the development projects funded by PRODERI need to be accompanied by training and technical assistance in order to be successful. Surprisingly, the program did not significantly increase the likelihood of households to receive training or technical advice. This finding suggests that either insufficient training and technical advice was delivered within PRODERI, or that the control households have also received them, possibly through other governmental or non-governmental programs or even independently of any programs. The PO-level data reveal that the members of 72 per cent of treated and 64 per cent of control POs attended training in the three years prior to the survey. Hence, there is only a slight difference in training participation, and the difference is not statistically significant.

Training and technical advice are, according to the information conveyed in the KIIs and FGDs, the most controversial issues around the implementation of PRODERI. All interviewees stated in one way or another that training is fundamental to the kinds of projects they had implemented. However, there

⁴⁰ The number of observations for treated POs varies across rows in this table because there is a missing value in our data for the number of youth members for one PO, and five POs reported that they do not have any leaders.

was quite a variation in how training within PRODERI was planned, conducted, and perceived. Many beneficiaries did not know about whether and which plans for training were included in the business plans of their development projects. This is an important insight, because it shows that training was not given the importance it deserved in the formulation of the business plans. The reasons for this may vary from one PO to another, although it can be hypothesised that the lack of awareness of training plans was particularly prevalent when projects were formulated with low beneficiary participation. In individual cases, the program technicians and consultants reportedly wrote the business plans without the involvement of beneficiaries. This was typically justified by referring to the time pressure for meeting the submission deadline.

Some interviewees mentioned that they never received any training and that it would have been highly desirable. Other interviewees said that they were trained, but that the training was not enough as they would have needed much more support. Training was also partly perceived as too theoretical. There were many other interviewees who said that the training provided was very useful and sufficient.

Training covered a wide range of topics, such as plumbing, irrigation installation, poultry farming, livestock management, marketing, accounting, and project formulation. Technical training, well focused on the specific demands of the beneficiaries, was highly valued by the beneficiaries because this training allowed them to solve very concrete and urgent problems. The role of the *Instituto Nacional de Tecnología Agropecuaria* (INTA) was particularly recognised and valued by the beneficiaries, as this institute provided many of the training courses on the use of machinery, livestock and pasture production, food processing, and similar topics. In contrast, other training courses, often provided by PRODERI technicians, focused on much more general topics, such as project management and cooperation with other programs or policies. These courses did not provide elements for the resolution of specific technical problems (handling of machinery, construction of greenhouses, etc.), but they were nevertheless well received.

Regarding technical assistance, there were contrasting statements in the FGDs, some of which very negative and others very positive, and hence no clear picture emerged. For example, one focus group in an indigenous community mentioned that the extent of technical assistance was far too small, and that the provincial technician assigned to their project was suddenly not available anymore.⁴¹ The participants expressed clear disappointment about the lack of support by the government. In other focus groups, the perception was quite opposite to this. In one case, for example, the technician who provided technical assistance was praised for helping with the implementation of their productive activities as well as with commercialization and organizational aspects.

Importantly, there were situations when the budget for training and technical assistance was reduced. This may have happened either due to a lack of resources (because of inflation) or due to the fact that priority was given to the completion of investments over training and technical assistance.

c) Formalization and capitalization of producer organizations

As noted above, it is a crucial assumption in the program's ToC that formalization and capitalization of POs help to improve the productive capacities and market opportunities of their members. We shed some light on these topics based on both survey data and qualitative interviews. A first notable insight is a relatively high level of formalization of POs, as the share of POs with legal status⁴², written by-laws and accounting books is around 80 per cent, both among treated and control POs (Table 22).⁴³ PRODERI did not have an impact on these indicators. It also did not change access to loans and the use of external funds for working capital. However, the program increased the likelihood to have a bank account by 28 percentage points and to use external funds for investments by 20 percentage points. These impacts are not surprising because they reflect how PRODERI was implemented. Supported POs were requested to have a bank account, to which program funds could be transferred, and these program funds were primarily in the form of grants. The fact that treated POs still maintain their bank account after the completion of PRODERI can be interpreted as a good sign and gives an indication of achieved sustainability. An interesting insight is that a substantial share of control POs also had external funds at their disposal. This underlines the point made above that they may have benefitted from other rural development programs.

⁴¹ Sabourin et al. (2020) report of a dramatic reduction on the number of technicians assisting farmers and especially family farmers during the latter half of PRODERI. Nearly 60% of governmental technicians were dismissed between 2016 and 2018, and some areas of the country virtually left unattended.

⁴² A PO that has legal status is registered in the *Inspección General de Justicia* and AFIP.

⁴³ The number of observations is lower for the last two rows in this table because several POs reported that they did not require any working capital or did not make any investments in the last three years.

Table 22: PRODERI impact on formalisation and capitalisation of POs

Variable	Impact	Control Mean	Observations
Legal status (%)	-0.003	0.77	231
By-laws (%)	0.03	0.82	231
Accounting books (%)	-0.05	0.88	231
Bank account (%)	0.28 ***	0.51	231
Access to loans (%)	0.03	0.04	231
Funding for working capital (%)	0.11	0.34	200
Funding for investment (%)	0.20 ***	0.48	171

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results are from nearest neighbor PSM. For binary outcomes, the control mean corresponds to a share. Impact on binary outcomes is expressed in percentage points.

In sum, we find that treated POs are, on the one hand, not more formalized but, on the other hand, differently capitalized than control POs, at least in the three years prior to our survey. Has this capitalization improved the productive capacities and market opportunities of the PO members? We explained above that, for the case of market access, the likelihood of success depended a lot on the POs' remoteness, experience with previous rural development programs, and receipt of training and technical assistance. Many POs, especially those more remote, were reportedly not able to explore new market opportunities.

Many of our interview participants, especially the provincial program officials, questioned the intention of the program to increase the level of formalization. They state that it is a contradiction to want to help the poorest and most remote and to require them to formalize (such as to register as an organization or to open a bank account). Especially for the most remote POs, formalization is difficult as they are located far from public offices and banks, often do not have access to information technologies, and lack the necessary technical capacity or assistance to carry out the required procedures. Some of our interviewees expressed that the required formalization generates a process of exclusion, where those that are intended to be supported most can least participate and benefit. One interviewee expressed this very well by saying that "if one intends to improve rural life but imposes urban conditions, it is a contradiction in terms".

5.3 Heterogenous impacts of PRODERI

We present results for selected outcome and impact indicators for the two poorest regions of Argentina, i.e., NOA and NEA, to explore the potential heterogeneity of impact. This analysis is of interest because these two regions were the major focus of PRODERI, as it aimed to particularly improve the situation of households in these areas. Households in NOA and NEA make up two thirds of our sample.

Overall, the findings are comparable to those based on the overall data (Table 23). In particular, the magnitude of the impact estimates is quite close to the national results for all indicators. Yet, there are some deviations in terms of statistical significance, though only for indicators of economic mobility, productive capacities, and women's empowerment. We no longer find a statistically significant impact of the program for gross household income, the value of crop production, the value of animal-related production, and the likelihood of female members or leaders in the PO. It needs to be taken into consideration that it is more difficult to obtain significant results with a smaller sample. Hence, while there may still be changes attributable to PRODERI, it is possible that we cannot detect them with the data at hand. An interesting new insight is the impact on the housing assets index: PRODERI increased this index by 16 per cent. Such an improvement was not observed at the national level, which leads us to conclude that increases in agricultural production and income translated into improvements in housing in the two Northern regions but not the rest of the country.

Table 23: PRODERI impact in NOA and NEA regions

	Impact		Control Mean	Observations
Economic mobility				
Gross household income ⁽¹⁾	11.48		570,945	880
Gross agricultural income ⁽²⁾	33.97	*	166,909	756
Housing assets index	16.06	**	0.32	919
Durable assets index	-16.27		0.33	919
Productive assets index	29.42		0.09	919
SO1-Productive capacities				
Value of total agricultural production ⁽²⁾	79.05	**	132,331	796
Total value of crop production ⁽²⁾	37.34		108,960	468
Total value of animal-related production ⁽²⁾	20.46		79,544	608
SO2-Market access				
HH sold any agricultural products	11.56	***	0.79	801
HH sold crops	9.62		0.50	469
HH sold animal-related products	7.49	*	0.75	624
Value of crop sales ⁽¹⁾	86.47		58,709	269
Value of animal-related sales ⁽¹⁾	19.42		87,219	467
SO3-Resilience				
Income diversification	-3.26		0.42	880
Ability to recover from shocks	-2.53		0.20	687
Nutrition and food security				
Household dietary diversity score	-1.10		10.16	919
Food insecurity experience scale	2.99		1.65	919
Women's empowerment				
Female alone owns majority of assets	-1.36		0.19	919
Female owns majority of assets jointly with male	-7.60	*	0.46	919
HH member who is PO member is female	-5.11		0.36	919
Female PO member is part of PO leadership	1.38		0.32	340

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

Another potential heterogeneity in impact can be expected depending on how long a PO and its members have been exposed to PRODERI activities. To assess whether this dimension led to differences in estimated impact, we also conducted a separate analysis for projects that were approved comparably early during program implementation. As mentioned in Section 2.2, early and late approved projects deviate from each other in the sense that early projects were usually more comprehensive. This fact could lead to the expectation that early projects may have had a larger impact on the beneficiary households. We run impact estimates for all treated projects that received their first tranche of PRODERI funding before 2018. Somewhat surprisingly, the findings are very close to the overall findings. The only differences we find are that the estimated impacts of the program on wage income, the value of crop production per hectare, and the value of animal-related production are not statistically significant. All other impact estimates are of a similar magnitude and the same level of statistical significance as found in Section 5.1. Results are available from the authors upon request.

6. Conclusion and recommendations

PRODERI aimed to sustainably improve the living conditions of rural households in Argentina. The program provided funding and technical support to POs and indigenous communities to engage in productive development projects and to invest in community needs. The objective of these investments was to increase the productive capacities and market access of small-scale rural producers, thus raising incomes and reducing poverty. As part of the IFAD11 Impact Assessment Agenda, this report presents the results of a rigorous IA that analysed PRODERI's impacts, to generate lessons to inform future program design and implementation. Quantitative estimates of impact that is attributable to PRODERI are enriched with insights from qualitative data, which help to interpret the findings and shed light on channels through which impact may have been achieved.

We find that beneficiary households substantially increased their agricultural production, both of crops and animal-related products. This increase in production led to more households selling their produce, but – among those selling – not to higher revenues from sales. Ultimately, PRODERI led to significant increases in agricultural income and total household income (both of which contain values for home consumption of own production). There was no attributable impact on asset ownership of the beneficiaries.

PRODERI did not have an attributable impact on the nutritional status and food security of the beneficiary households. While this finding may seem surprising, it needs to be interpreted in light of very good starting conditions of households in our sample with respect to both their level of dietary diversity and food security, and from which a further improvement seems difficult to achieve.

We find mixed results regarding the impact of the program on resilience to shocks. While the impact estimates suggest that beneficiary households that recently experienced shocks are worse off than the control group in terms of their ability to recover from shocks, the impression of beneficiaries conveyed in qualitative interviews is quite the opposite. Yet, these interviews are only partly comparable to the survey data, as they capture the impressions of all households, i.e., those that had experienced shocks and those that had not.

There are a number of caveats to our analysis. First, the set of PRODERI-funded projects considered for this IA exclude rare project activities as well as projects that focused on water supply for consumption purposes. Second, our sampling design does not allow for the investigation of potential heterogeneities in impacts, as a much bigger household sample would have been needed with considerable implications for the impact assessment budget. Although we recognize it would be important to assess the impacts separately for each province, for indigenous groups, and for the different funding lines within PRODERI, we are limited in studying these due to how the sample was constructed. Third, we collected data in the middle of the COVID-19 pandemic. Notwithstanding our efforts to ensure that the estimated impacts are not systematically affected by the pandemic, it is likely that the magnitudes of our impact estimates may be different from what they would have been had we conducted the survey before the pandemic.

Six main lessons can be drawn from this IA to guide future program design and implementation:

1. **Financial support to rural producers through POs can have substantial effects on agricultural production and rural incomes.** This IA shows that PRODERI substantially increased the value of agricultural production as well as agricultural and total household income for the beneficiary households. According to the qualitative data, households also diversified their productive activities. The crucial program activities that made these impacts possible, according to our interviewees, were investment in water and farm infrastructure as well as acquisition of machinery and inputs.
2. **Programs fostering agricultural production may reduce dependence on welfare benefits.** PRODERI reduced the share of total household income obtained from transfers and other income, which mostly consists of pensions and governmental assistance, for the program beneficiaries. At the same time, it increased the share of agricultural income.
3. **Support to POs is critical to enhance the use of heavy agricultural machinery.** Among other purposes, PRODERI provided funding for the acquisition of machinery, and many treated POs seem to have made use of this opportunity. Substantially more treated than control POs owned tractors at the time of data collection, and these tractors were widely used by the PO member households. Impact estimates show that the program increased PO members' use of machinery,

which is otherwise difficult to access and contributes to the increase in productive capacities and incomes.

4. **Women's participation in POs does not necessarily lead to their empowerment within the household.** PRODERI demanded women's and youth participation in the design and implementation of the funded development projects. Our data show that there was indeed widespread involvement of women and youth in these projects. PRODERI significantly increased the likelihood for women to be part of the PO leadership in households with a female PO member. However, participation of women in the development projects as well as their engagement in the PO's leadership did not translate into more empowerment of women in their households, as women in beneficiary households neither increased ownership of assets nor their decision-making on agricultural activities or the use of income.
5. **Program design is crucial to ensuring impacts.** Many of our interview partners were of the impression that the program designers did not sufficiently take the local context of the POs and their members into consideration. One of the main results of this IA is that increased market access was only partially achieved among the beneficiary households. A major reason appears to be the remote location of many producers and POs, implying poor mobile phone and internet connectivity, a poor road network, and long distances to potential buyers, public offices, and banks. These factors make formalization of both POs and producing households as well as establishment of stable market linkages difficult. It was thus stated that if a program intends to provide support for the poorest and most remote, it should be designed for their realities and should have realistic objectives. Designing a program with more information about the target group would ensure that interventions are suitable to achieve the program goals and are more effective in facilitating rural transformation. In addition, the development projects implemented by POs were usually accompanied by training courses and technical assistance, both of which were considered instrumental by the beneficiaries for the projects' success. However, there appear to have been differing experiences, and thus varying satisfaction, with the training and technical assistance provided as part of PRODERI. Given the importance of these program activities, future programs need to ensure that training and technical assistance are provided on a continuous basis and with the relevant content.
6. **Impacts can be increased by addressing constraints to program implementation.** Our interviewees have expressed the imperative need to streamline and execute the program in much less time and in a more simplified way, especially given the inflationary context in Argentina. It was also requested to reduce the heavy bureaucracy around budgets and accountability.

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Appendix 1: Balance diagnostics and tests of matching

Table 24: T-test of matching variables: unmatched vs. matched sample

Variables	Unmatched sample			Matched sample		
	Treated group	Control group	Standardized difference	Treated group	Control group	Standardized difference
Durable assets index at baseline	0.54	0.55	-0.01	0.54	0.54	0.01
Productive assets index at baseline	0.10	0.06	0.15***	0.09	0.09	-0.01
Household was already member of PO at baseline	0.43	0.46	-0.07	0.43	0.43	0.00
Age of household head at baseline	43.23	43.27	-0.00	43.14	43.31	-0.01
Household head has no or incomplete primary education	0.14	0.17	-0.10*	0.14	0.13	0.03
Household head completed primary education	0.56	0.57	-0.03	0.56	0.57	-0.02
Household head completed secondary education	0.21	0.18	0.09	0.21	0.22	-0.02
Household head completed tertiary education	0.10	0.08	0.06	0.09	0.09	0.03
Household head female	0.24	0.30	-0.15***	0.25	0.22	0.05
Household grows crops	0.54	0.49	0.11**	0.53	0.56	-0.05
Household raises livestock or does poultry farming	0.60	0.64	-0.07	0.62	0.64	-0.05
Share of households with unmet basic needs in community (in 2010)	0.16	0.17	-0.05	0.17	0.18	-0.06
Share of households with access to potable water in community (in 2010)	0.65	0.60	0.11**	0.65	0.64	0.02
Travel time from community to next city (minutes)	70.78	70.23	0.01	70.71	71.43	-0.01
Proportion of rangeland around the community	0.02	0.03	-0.04	0.02	0.03	-0.02
Euclidean distance to next freshwater surface (metres)	4,142.73	4,607.52	-0.10*	4,193.43	4,266.19	-0.02

Variables	Unmatched sample			Matched sample		
	Treated group	Control group	Standardized difference	Treated group	Control group	Standardized difference
Population density in community at baseline	2.23	2.94	-0.13**	2.18	2.22	-0.01
Average annual rainfall in community (1982-2011)	727.40	728.22	-0.00	728.26	734.58	-0.01
Coefficient of variation (CoV) of annual rainfall (1982-2011)	0.18	0.18	-0.03	0.18	0.18	-0.05
Ratio of CoV of annual rainfall 2008-2011 over 1982-2007	0.73	0.67	0.13**	0.72	0.74	-0.04
Average annual temperature in community (1982-2011)	17.35	16.78	0.12**	17.33	17.40	-0.02
Coefficient of variation in annual temperature (1982-2011)	0.03	0.03	-0.03	0.03	0.03	-0.05
Ratio of CoV of annual temperature 2008-2011 over 1982-2007	0.86	0.87	-0.04	0.85	0.85	0.02
NOA	0.36	0.44	-0.16***	0.37	0.36	0.02
NEA	0.26	0.27	-0.00	0.27	0.28	-0.03
Pampas	0.16	0.10	0.18***	0.15	0.15	0.00
Cuyo	0.15	0.15	0.02	0.16	0.15	0.03
Patagonia	0.06	0.05	0.05	0.06	0.06	-0.02
No. of observations	706	686	1,392	685	686	1,371

Note: Columns (2), (3), (5), and (6) report mean of the respective group and sample. Matched sample is weighted using sample weights generated by PSM. Asterisks indicate the level of statistical significance from t-test: * < 0.10; ** < 0.05; *** < 0.01.

Figure 5: Reduction of bias in matching variables in standardized percentage

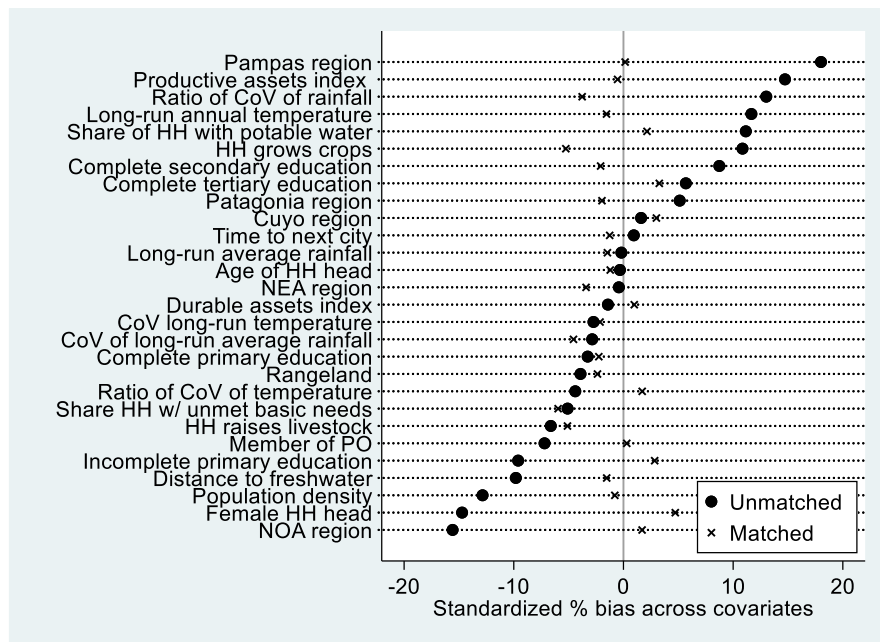
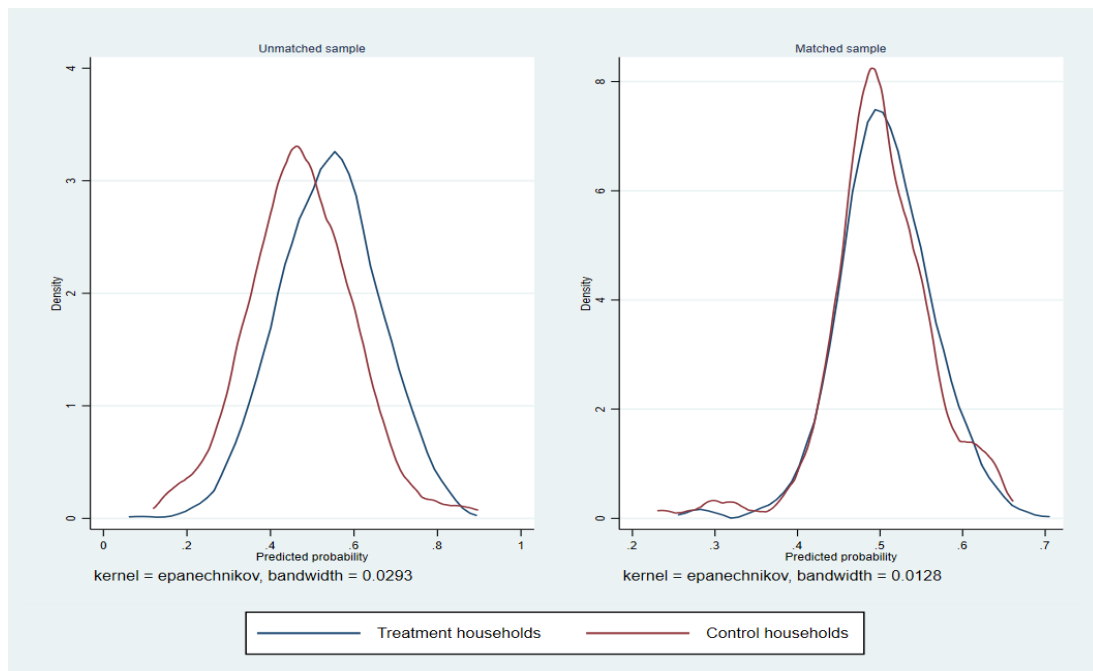


Figure 6: Kernel density of the predicted probability of being selected in the unmatched and matched sample



Appendix 2: List of control variables used in the impact estimation

Table 25: List of control variables used in the outcome equation of IPWRA

Name of variable	Gross income	Asset ownership	Agricultural production	Crop production	Animal production	Crop sales	Animal sales	Income diversification	Ability to recover from shocks	Food and nutrition security	Women's empowerment
Household size (per adult equivalent)	x	x	x	x	x	x	x	x	x	x	x
Share of dependents (younger than 16 or older than 64)	x	x	x	x	x	x	x	x	x	x	x
Share of women among non-dependents	x	x	x	x	x	x	x	x	x	x	x
If any household member has a disability (1=yes)	x	x	x	x	x	x	x	x	x	x	x
If household head is female (1=yes)	x	x	x	x	x	x	x	x	x	x	x
If household head is married (1=yes)	x	x	x	x	x	x	x	x	x	x	x
If household head is indigenous (1=yes)	x	x	x	x	x	x	x	x	x	x	x
Age of household head in years	x	x	x	x	x	x	x	x	x	x	x
Age of household head in years (squared)	x	x	x	x	x	x	x	x	x	x	x
If household head has no or incomplete primary education (1=yes)	x	x	x	x	x	x	x	x	x	x	x

Name of variable	Gross income	Asset ownership	Agricultural production	Crop production	Animal production	Crop sales	Animal sales	Income diversification	Ability to recover from shocks	Food and nutrition security	Women's empowerment
If household head has complete primary education (1=yes)	x	x	x	x	x	x	x	x	x	x	x
If household head has complete secondary education (1=yes)	x	x	x	x	x	x	x	x	x	x	x
If household head has complete tertiary education (1=yes)	x	x	x	x	x	x	x	x	x	x	x
PCA index of durable assets at baseline (normalized 0 to 1)	x	x	x	x	x	x	x	x	x	x	x
PCA index of productive assets at baseline (normalized 0 to 1)	x	x	x	x	x	x	x	x	x	x	x
Hectares of land owned by the household	x	x	x	x	x	x	x	x	x	x	x
Household lives in NOA region (1=yes)	x	x	x	x	x	x	x	x	x	x	x
Household lives in NEA region (1=yes)	x	x	x	x	x	x	x	x	x	x	x
Household lives in Cuyo region (1=yes)	x	x	x	x	x	x	x	x	x	x	x
Household lives in Pampas region (1=yes)	x	x	x	x	x	x	x	x	x	x	x
Household lives in Patagonia region (1=yes)	x	x	x	x	x	x	x	x	x	x	x
PCA index of COVID exposure (normalized 0-1)	x	x	x	x	x	x	x	x	x	x	x

Name of variable	Gross income	Asset ownership	Agricultural production	Crop production	Animal production	Crop sales	Animal sales	Income diversification	Ability to recover from shocks	Food and nutrition security	Women's empowerment
Group membership, other than PO (1=yes)	x	x	x	x	x	x	x	x	x	x	x
Total rainfall in last 12 months	x	x	x	x	x	x	x	x	x	x	x
Ratio of CoV of annual average rainfall in project period over long-run CoV	x	x	x	x	x	x	x	x	x	x	x
Ratio of CoV of annual average temperature in project period over long-run CoV	x	x	x	x	x	x	x	x	x	x	x
Travel time to the next 5-10k city in minutes	x	x	x	x	x	x	x	x	x	x	x
Number of health facilities in community	x	x	x	x	x	x	x	x	x	x	x
Population density in 2020	x	x	x	x	x	x	x	x	x	x	x
Distance from community to next paved road in km	x	x	x	x	x	x	x	x	x	x	x
Elevation	x	x	x	x	x	x	x	x	x	x	x
Number of parcels			x	x	x						
If household experienced non-climatic shock in last 12 months (1=yes)	x							x		x	
If household experienced climatic shock in last 12 months (1=yes)	x		x	x	x	x	x	x		x	
If some portion of land is irrigated (1=yes)				x							

Name of variable	Gross income	Asset ownership	Agricultural production	Crop production	Animal production	Crop sales	Animal sales	Income diversification	Ability to recover from shocks	Food and nutrition security	Women's empowerment
If household used improved crop seeds (1=yes)						x					
If household received training on sales or marketing since baseline (1=yes)						x	x				
If household received training on crop production since baseline (1=yes)				x							
If household received training on animal production since baseline (1=yes)					x						
If household used productive assets provided by the PO (1=yes)			x	x	x	x	x				

Appendix 3: Inverse-Probability-Weighted Regression Adjustment results

Table 26: PRODERI impact on economic mobility, ATET

	ATET		Control Mean	Observations		
				Total	Treated	Control
Gross household income ⁽¹⁾	0.15 ** (0.06)		13.24	1310	659	651
Gross household income, adult equivalent ⁽¹⁾	0.16 ** (0.06)		12.09	1310	659	651
Wage income ⁽²⁾	0.20 * (0.12)		13.03	640	336	304
Gross agricultural income ⁽²⁾	0.35 *** (0.12)		12.67	1135	582	553
Gross self-employment income ⁽²⁾	-0.07 (0.26)		12.53	267	131	136
Transfer and other income ⁽²⁾	-0.10 (0.08)		12.71	987	480	507
Housing assets index	0.02 (0.02)		0.32	1371	685	686
Durable assets index	-0.04 (0.03)		0.40	1371	685	686
Productive assets index	0.04 (0.02)		0.11	1371	685	686
Tropical livestock units ⁽²⁾	0.03 (0.11)		1.76	1339	667	672

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

Table 27: PRODERI impact on productive capacities, ATET

	ATET		Control Mean	Observations		
				Total	Treated	Control
Value of total agricultural production ⁽²⁾	0.56 *** (0.18)		12.57	1193	601	592
Total value of crop production ⁽²⁾	0.65 *** (0.24)		12.16	685	358	327
Value of crop production per hectare ⁽²⁾	0.42 ** (0.18)		11.82	685	358	327
Total value of animal-related production ⁽²⁾	0.54 * (0.29)		11.67	841	412	429

Value of animal-related production per TLU ⁽²⁾	0.30 (0.26)	9.71	806	391	415
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Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

Table 28: PRODERI impact on market access, ATET

	ATET	Control Mean	Total	Observations Treated	Control
HH sold any agricultural products	0.09 *** (0.03)	0.81	1203	609	594
HH sold crops	0.04 (0.05)	0.62	697	363	334
HH sold animal-related products	0.10 *** (0.04)	0.73	858	422	436
Value of crop sales ⁽¹⁾	0.06 (0.24)	11.78	437	235	202
Value of animal-related sales ⁽¹⁾	0.07 (0.22)	11.48	656	345	311
Share of crop sales in crop production	0.04 (0.04)	0.46	695	365	330
Share of animal-related sales in animal-related production	0.00 (0.02)	0.85	817	409	408
HH sells crops to formal buyer	0.00 (0.05)	0.47	446	241	205
HH sells animal-related products to formal buyer	0.03 (0.05)	0.32	670	350	320

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

Table 29: PRODERI impact on resilience, ATET

	ATET	Control Mean	Total	Observations Treated	Control
Income diversification	0.01 (0.01)	0.39	1310	659	651
Ability to recover from shock	-0.05 (0.03)	0.22	1067	537	530
Ability to recover from climatic shock	-0.04 (0.03)	0.20	911	454	457

Ability to recover from non-climatic shocks	-0.06 * (0.03)	0.23	686	363	323
Corrected ability to recover (all shocks)	-0.13 ** (0.06)	2.21	1067	537	530
Corrected ability to recover (climatic shocks)	-0.07 (0.08)	2.12	911	454	457
Corrected ability to recover (non-climatic shocks)	-0.18 *** (0.07)	2.27	686	363	323

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

Table 30: PRODERI impact on nutrition and food security, ATET

	ATET	Control Mean	Total	Observations Treated	Control
Household dietary diversity score	-0.03 (0.11)	10.13	1371	685	686
Food insecurity experience scale	-0.02 (0.18)	1.64	1371	685	686
Household is food secure	0.01 (0.03)	0.78	1371	685	686
Household is moderately food insecure	-0.02 (0.03)	0.17	1371	685	686
Household is severely food insecure	0.00 (0.02)	0.07	1371	685	686

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.

Table 31: PRODERI impact on women's empowerment, ATET

	ATET	Control Mean	Total	Observations Treated	Control
Ownership of assets: majority by ...					
- Only female	0.00 (0.02)	0.17	1371	685	686
- Jointly with man	-0.06 * (0.03)	0.47	1371	685	686
Decision making about agricultural production					
- Only female	0.00 (0.02)	0.17	699	365	334

- Jointly with man	-0.10 ** (0.04)	0.28	699	365	334
Decision making about livestock rearing					
- Only female	-0.02 (0.03)	0.21	858	422	436
- Jointly with man	-0.03 (0.04)	0.35	858	422	436
Decision making about use of earnings from at least one income source					
- Only female	-0.05 * (0.03)	0.42	1371	685	686
- Jointly with man	-0.01 (0.03)	0.44	1371	685	686
At least one female HH member is wage employed	0.02 (0.03)	0.19	1371	685	686
PO member is female	-0.06 ** (0.03)	0.35	1371	685	686
Female PO member is part of leadership	0.10 ** (0.05)	0.26	473	200	273

Notes: *, **, & *** represent statistical significance at the 10%, 5%, & 1% level respectively. Results from IPWRA regressions with standard errors clustered at the PO level. Regressions include covariates listed in Appendix 2. Control mean corresponds to the potential outcome mean and is expressed in the outcome's original unit. For binary outcomes, the control mean corresponds to a share. All monetary variables are expressed in ARS. Impact on continuous outcomes is expressed in per cent, while impact on binary outcomes is expressed in percentage points. (1) indicates that a natural log transformation and (2) that an inverse hyperbolic sine transformation was used.



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